```
/*****************************************************************************
 *
 * Function:  control_engine_follower
 *
 * Description:
 *      This function sets the override_control_mode to no over ride so that
 *      the engine follows the accelerator demand.
 *
 *****************************************************************************/

static void control_engine_follower(void)
{

#define POSITIVE_PEDAL_TRANSITION_TIME     25  /* 250 MSEC */
#define NEGATIVE_PEDAL_TRANSITION_TIME     40  /* 400 MSEC */


  engine_status = ENGINE_FOLLOWER_MODE;

  if ((accelerator_pedal_position >= 5) &&    /* positive pedal transition */
      (accelerator_pedal_position_old <= 4) &&
      (low_speed_latch == FALSE))
  {
    positive_pedal_trans = TRUE;
    zero_flywheel_trq_time = POSITIVE_PEDAL_TRANSITION_TIME;
    if (zero_flywheel_trq_timer >= NEGATIVE_PEDAL_TRANSITION_TIME)
      zero_flywheel_trq_timer = 0;
  }

  else
  {
    if ((accelerator_pedal_position <= 4) &&   /* negative pedal transition */
        (accelerator_pedal_position_old >= 5) &&
        (low_speed_latch == FALSE))
    {
      zero_flywheel_trq_time = NEGATIVE_PEDAL_TRANSITION_TIME;
      zero_flywheel_trq_timer = 0;
    }
  }

  if ((zero_flywheel_trq_timer < zero_flywheel_trq_time) &&
      (current_gear > 1) && (current_gear < 10) && (low_speed_latch == FALSE))
  {
    engine_control = TORQUE_CONTROL;
    command_ETC1 = C_ETC1_OVERSPEED;
    desired_engine_pct_trq = needed_percent_for_zero_flywheel_trq;

    if (actual_engine_pct_trq < (needed_percent_for_zero_flywheel_trq + 5));
      zero_flywheel_trq_timer++;
  }

  else
  {
    if ((positive_pedal_trans == TRUE) && (low_speed_latch == FALSE))
    {
      positive_pedal_trans = FALSE;
      engine_commands = ENGINE_RECOVERY;       /* engine: finish torque return */
      control_engine_recovery();
    }

    else
    {
      engine_control = OVERRIDE_DISABLED;
      command_ETC1 = C_ETC1_NORMAL;
    }
  }

  /* if predip_mode had been forced, this is the place to clear its flag.    */
  /* But only clear it if the pedal is depressed.  This is for the case when */
  /* a false confirmed gear is seen but the driver actually is coasting down. */
  if (accelerator_pedal_position > 4)
    forced_predip = FALSE;

}
#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  control_engine_idle
 *
 * Description:
 *      This function sets the engine controls for the idle mode.
 *
 *****************************************************************************/

static void control_engine_idle(void)
{
   engine_control = OVERRIDE_DISABLED;
   command_ETC1 = C_ETC1_NORMAL;

   engine_status = ENGINE_IDLE_MODE;
}

#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  control_engine_start
 *
 * Description:
 *      This function sets the engine controls for the start mode.
 *
 *****************************************************************************/

static void control_engine_start(void)
{
   engine_control = OVERRIDE_DISABLED;
   command_ETC1 = C_ETC1_NORMAL;

   engine_status = ENGINE_START_MODE;
}

#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  control_engine_compression_brake
 *
 * Description:
 *      This function controls the state of the engine compression brake.
 *      The brake can be used during upshifts to speed up the decel rate of
 *      the input shaft.
 *
 *****************************************************************************/

static void control_engine_compression_brake(void)
{
   if (engine_communication_active &&
      (engine_status == ENGINE_SYNC_MODE) &&
      (shift_type == UPSHIFT) &&
      (input_speed_filtered > (gos + 150)) &&
      (destination_gear > 1) &&
      (destination_gear < 7) &&
      (engine_brake_available) &&
      ((dos_predicted < dos_prdtd_lim_no_jake) || eng_brake_assist))
   {
      eng_brake_assist = TRUE;
   }
   else
   {
      eng_brake_assist = FALSE;
   }

   eng_brake_assist = FALSE;   /* debug - force false state for now */
}

#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  determine_gos
 *
 * Description:
 *      This function mulitplies the destination gear ratio times the
 *      output shaft speed for use in the DRL_CMDS module.
 *
 *                  gos = (g)ear * (o)utput (s)peed
 *
 *****************************************************************************/

static void determine_gos(void)
{

  /*** determine gos for the destination_gear ***/
   _bx = trn_tbl.gear_ratio[destination_gear + GR_OFS];
   _cx = output_speed_filtered;      /* output speed */
   asm mulu _cxdx, _bx;              /* BIN 8 result */
   asm shrl _cxdx, #8;               /* make BIN 0   */
   gos = _cx;                        /* BIN 0        */

   _bx = trn_tbl.gear_ratio[destination_gear + GR_OFS];
   _cx = *(uint *)&dos_filtered;
   asm mul _cxdx, _bx;
   asm div _cxdx, #256;
   dgos = *(int *)&_cx;

   gos_signed = (signed int)(gos);   /* allow signed math in other functions*/

   /*** determine gos for the "current_gear" ***/
   _bx = trn_tbl.gear_ratio[current_gear + GR_OFS];
   _cx = output_speed_filtered;      /* output speed */
   asm mulu _cxdx, _bx;              /* BIN 8 result */
   asm shrl _cxdx, #8;               /* make BIN 0   */
   gos_current_gear = _cx;           /* BIN 0        */

}

#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  determine_shiftability_variables
 *
 * Description:
 *      This function filters both the output speed and the rate of change of
 *      the output speed for use in the shiftability function. This function
 *      also calulates the rate of change of the input shaft based on the
 *      filtered value for the rate of change of the output shaft.
 *
 *      The filters used in this function are required to get a high level of
 *      stability.  The BIN 8 filter used here will provide a much smoother
 *      output which is needed to filter out driveline oscillations.
 *
 *      Note:  These calculations were placed in this module because it is
 *      called on a regular 10 msec interval.  These calculations should
 *      be placed in the pr_i_s_i.c96 module once shiftability is proven.
 *      These variables are used in the SEL_GEAR.C96 module.
 *
 *****************************************************************************/

static void determine_shiftability_variables(void)
{
   /* LPF coefficients: exp(-wT), T=0.010s */
   #define OS_LPF       248      /* 0.9691 BIN 8 (0.50Hz) */
   #define DOSFK1       249      /* 0.9727 BIN 8 (0.44Hz) */
   #define EPTFK1       252      /* 0.9844 BIN 8 (0.25Hz) */

   #define IS_FK1       235      /* 0.9219 BIN 8 (0.??Hz) */
   #define OS_FK1       236      /* 0.9219 BIN 8 (0.??Hz) */
   #define DISFK1       236      /* 0.9219 BIN 8 (0.??Hz) */

  #define LOW_RANGE    3197      /* 3.1224 BIN 10         */
  #define BIN_10       1024

   static long dos_filtered_bin8;
   static int ept_filtered_bin8;

unsigned long is_filtered_partial_1;
unsigned long is_filtered_partial_2;
unsigned long os_filtered_partial_1;
unsigned long os_filtered_partial_2;

   /** create lpf_output_accel **/

   _bx = *(uint *)&output_speed_accel;            /* _bx = x(n), BIN 0 */
   _cx = *(uint *)&lpf_output_accel - _bx;        /* _cx = y(n-1) - x(n), BIN 0 */
   asm mul _cxdx, #OS_LPF;                         /* _cxdx = K*(...), BIN 8 */
   asm div _cxdx, #256;                            /* make BIN 0 */
   _bx += _cx;                                     /* _bx = x(n) + K*(...), BIN 0 */
   lpf_output_accel = *(int *)&_bx;                /* save acceleration */

   /** dos_filtered = (dos_filtered * DOSFK1) + (lpf_output_accel * (1-DOSFK1) **/

   _cxdx = *(ulong *)&dos_filtered_bin8;           /* BIN 8 */
   asm shral _cxdx, #2;                            /* BIN 6 (_cx) */
   asm mul _cxdx, #DOSFK1;                         /* BIN 14 */
   asm shral _cxdx, #6;                            /* BIN 8 */
   dos_filtered_bin8 = *(long *)&_cxdx;            /* save partial result */

   _cx = *(uint *)&lpf_output_accel;               /* BIN 0 */
   _bx = 256 - DOSFK1;                             /* 1 BIN 8 - DOSFK1 */
   asm mul _cxdx, _bx;                             /* BIN 8 */
   dos_filtered_bin8 += *(long *)&_cxdx;           /* sum is final result */

   dos_filtered = (int)(dos_filtered_bin8 >> 8);   /* BIN 0 */

   /** eng_percent_torque_filtered = (eng_percent_torque_filtered * EPTFK1) +
                    (net_engine_pct_trq * (1-EPTFK1) **/

   _cx = *(uint *)&ept_filtered_bin8;              /* BIN 8 */
   asm mul _cxdx, #EPTFK1;                         /* BIN 16 */
   asm shral _cxdx, #8;                            /* BIN 8 */
   ept_filtered_bin8 = *(int *)&_cx;               /* save partial result */

   _cx = net_engine_pct_trq;                       /* BIN 0 */
   _bx = 256 - EPTFK1;                             /* 1 BIN 8 - EPTFK1 */
   asm mul _cxdx, _bx;                             /* BIN 8 */
   ept_filtered_bin8 += *(int *)&_cx;              /* sum is final result */
```

```
    eng_percent_torque_filtered = (char)(ept_filtered_bin8 >> 8);

    /** input_shaft_accel_calculated = dos_filtered * gear_ratio **/

    _cx = trn_tbl.gear_ratio[destination_gear + GR_OFS];   /* BIN 8 */
    _bx = *(uint *)&dos_filtered;                          /* BIN 0 */
    asm mul _cxdx, _bx;                                    /* BIN 8 */
    asm shral _cxdx, #8;                                   /* BIN 0 */
    input_shaft_accel_calculated = *(int *)&_cx;

   /***  calculate filtered input and output shaft speeds for AutoSplit  ***/

    /***  determine os_based_on_rcs variable  ***/
    if (output_speed < 1000)
    {
      _bx = aux_speed;                                     /* BIN 0 */
      _cx = BIN_10;                                        /* BIN 10 */
      _ax = LOW_RANGE;                                     /* BIN 10 */
      asm mulu _cxdx, _bx;                                 /* make aux_speed BIN 10 */
      asm divu _cxdx, _ax;                                 /* divide by low range BIN 10 */
      os_based_on_rcs = _cx;                               /* BIN 0 */
    }

    /** input_speed_filtered = (input_speed_filtered * IS_FK1) +
                      (input_speed * (1-IS_FK1) **/

   _ax = (is_filtered_bin8 >> 4) ;                         /* BIN 4          */
   _cx = IS_FK1 ;                                          /* BIN 8          */
   asm mulu _axbx, _cx ;                                   /* BIN 12         */
   asm shrl _axbx, #4 ;                                    /* BIN 8          */
   is_filtered_partial_1 = _axbx ;                         /* BIN 8          */

   _cx = input_speed ;                                     /* BIN 0          */
   _ax = 256 - IS_FK1 ;                                    /* 1 BIN 8 - IS_FK1 */
   asm mulu _axbx, _cx ;                                   /* BIN 8          */
   is_filtered_partial_2 = _axbx ;                         /* BIN 8          */

   is_filtered_bin8 =  is_filtered_partial_1 + is_filtered_partial_2 ;

   input_speed_filtered = (unsigned int)(is_filtered_bin8 >> 8);  /* BIN 0          */


    /** output_speed_filtered = (output_speed_filtered * OS_FK1) +
                      (output_speed * (1-OS_FK1) **/

   _ax = (os_filtered_bin8 >> 4) ;                         /* BIN 4          */
   _cx = OS_FK1 ;                                          /* BIN 8          */
   asm mulu _axbx, _cx ;                                   /* BIN 12         */
   asm shrl _axbx, #4 ;                                    /* BIN 8          */
   os_filtered_partial_1 = _axbx ;                         /* BIN 8          */

#if (0)
  if (output_speed < 250)
    _cx = os_based_on_rcs;                                 /* BIN 0          */
  else
#endif
    _cx = output_speed ;                                   /* BIN 0          */

   _ax = 256 - OS_FK1 ;                                    /* 1 BIN 8 - OS_FK1 */
   asm mulu _axbx, _cx ;                                   /* BIN 8          */
   os_filtered_partial_2 = _axbx ;                         /* BIN 8          */

   os_filtered_bin8 =  os_filtered_partial_1 + os_filtered_partial_2 ;

   output_speed_filtered = (unsigned int)(os_filtered_bin8 >> 8);  /* BIN 0          */


    /** input_speed_accel_filtered = (input_speed_accel_filtered * DISFK1) + (input_shaft_accel * (1-DISFK1) **/

    _cxdx = *(ulong *)&dis_filtered_bin8;                  /* BIN 8          */
    asm shral _cxdx, #4;                                   /* BIN 4 (_cx)    */
    asm mul _cxdx, #DISFK1;                                /* BIN 12         */
    asm shral _cxdx, #4;                                   /* BIN 8          */
    dis_filtered_bin8 = *(long *)&_cxdx;                   /* save partial result */

    _cx = *(uint *)&input_speed_accel;                     /* BIN 0          */
    _bx = 256 - DISFK1;                                    /* 1 BIN 8 - DISFK1 */
    asm mul _cxdx, _bx;                                    /* BIN 8          */
    dis_filtered_bin8 += *(long *)&_cxdx;                  /* sum in final result */
```

```
   input_speed_accel_filtered = (int)(dis_filtered_bin8 >> 8);   /* BIN 0 */

   /** determine state of clutch **/  /***!!!! this is temporary until we get */
                                      /***     clutch state over J1939.  !!!***/
#if (0)
   if (engine_speed > input_speed)
     clutch_slip_speed = engine_speed - input_speed;
   else
     clutch_slip_speed = input_speed - engine_speed;

  if (clutch_slip_speed > 200)
     clutch_state = DISENGAGED;
  else
     if ((engine_speed > 700) && (low_speed_latch == FALSE))
       clutch_state = ENGAGED;  /* Note: 700 should be idle+100RPM */
#endif
/*** Below is a known undesirable condition that could be corrected with the J1939
     clutch state information.  When input speed is brought below 700 RPM
     while in gear and the clutch is disengaged to acheive gear box neutral this
     algorithm holds the system in the follower mode until the driver bring the
     engine speed above the 700 RPM limit. The 700 RPM limit is needed to prevent
     false ENGAGED indications at idle speeds. ***/


  /** determine desired percent torque needed for zero torque at flywheel **/

#if (0)
      /* This does not work but was not a problem to hard code a value
         because the accessory loading in this vehicle does not change
         much.  This algorithm DOES need to work for the product. */
  if ((accelerator_pedal_position < 2) &&
      (clutch_state == ENGAGED) &&
      (current_gear == 0) &&
      (input_speed_filtered < 1100) &&
      (((engine_control == OVERRIDE_DISABLED) &&
        (low_speed_latch == FALSE) && (current_gear == 0)) ||
        (output_speed_filtered < 20)))
    percent_torque_accessories = eng_percent_torque_filtered;  /* get at idle */
#endif
    percent_torque_accessories = 3;  /* force value for now */

  needed_percent_for_zero_flywheel_trq = percent_torque_accessories +
                                         nominal_friction_pct_trq;

  /** determine overall error across the transmission  **/
  overall_error = ((signed int)(input_speed_filtered) - (signed int)(gos));

}

#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  communicate_with_driveline
 *
 * Description:
 *      This is the periodic task which controls the actions of the engine
 *      by defining mode of control and controlling speed and torque output
 *      levels depending upon the control function being performed. This task
 *      is also intended for control of other driveline components (not yet
 *      named) which may be available in the future.
 *
 *****************************************************************************/

void communicate_with_driveline(void)
{
   initialize_driveline_data();

   x_start_periodic();
   while (1)
   {
      control_engine_compression_brake();

      determine_gos();   /* calculate (G)ear times the (O)utput (S)haft */

      determine_shiftability_variables();

      if ((engine_communication_active) &&
          (R747_type != BASE) &&
          (R747_type != DUAL_FORCE))
      {

        if ((desired_sync_test_mode == TRUE) && (output_speed_filtered < 100))
          control_engine_sync_test_mode();

        else
        {      /* start of normal engine_commands switch */

         switch (engine_commands)
         {
         case ENGINE_PREDIP:
            control_engine_predip();
            break;

         case ENGINE_SYNC:
            control_engine_sync();
            break;

         case ENGINE_RECOVERY:
            control_engine_recovery();
            break;

         case ENGINE_IDLE:
            control_engine_idle();
            break;

         case ENGINE_START:
            control_engine_start();
            break;

         case ENGINE_FOLLOWER:
         default:
            control_engine_follower();
            break;
         }
        }      /* end of normal engine_commands switch */

         switch (eng_brake_command)
         {
         case ENG_BRAKE_OFF:
            retarder_control = TORQUE_CONTROL;
            desired_retarder_pct_trq = 0;
            break;

         case ENG_BRAKE_FULL:
            retarder_control = TORQUE_CONTROL;
            desired_retarder_pct_trq = -100;
            break;

         case ENG_BRAKE_IDLE:
```

```
            default:
               retarder_control = OVERRIDE_DISABLED;
               desired_retarder_pct_trq = 0;
               break;
            }
         }
         else
            engine_status = ENGINE_NOT_PRESENT;

         /* store old value for use in "control_engine_follower" function */
         accelerator_pedal_position_old = accelerator_pedal_position;

         x_sync_periodic(US_PER_LOOP);
      }
      x_end_periodic();
   }
```

```
/*****************************************************************************
 *
 *        Unpublished and confidential.  Not to be reproduced,
 *        disseminated, transferred or used without the prior
 *        written consent of Eaton Corporation.
 *
 *        Copyright Eaton Corporation, 1994
 *        All rights reserved.
 *
 *****************************************************************************
 *
 * Filename:  pr_s_i_s.c96    (R-747) (AutoSplit)
 *
 * Description:
 *   The modules contained within this compilation unit are
 *   intended to implement functionality of the Process System
 *   Input Signals task defined in the design documention.
 *   In general, Analog to digital conversions are started on
 *   Port0. The necessary hardware initialization and variable
 *   initializtion for inputs on Port0 are handled.  The switch
 *   inputs are captured to avoid conflict with AD conversions
 *   and all necessary scaling and error check for these inputs
 *   is conducted.
 *
 * Part Number:  <none>
 *
 * $Log:   ?
 *
 *    Rev 1.3    9 Dec 1994 15:06:    markyvech
 * Added "trns_act.h" to the includes so that R747_type could be use to
 * determine if the electric shift knob is a splitter type or a intent to
 * shift type.
 *
 *    Rev 1.2    6 Dec 1994 15:06:    markyvech
 * Converted for use with R-747 program.  (Added clutch & range switches)
 * Also re-scaled ECU-B ignition A2D code to work in ECU-II.
 *
 *    Rev 1.1   19 May 1994 11:32:26   markyvech
 * Converted for use with AutoSplit ECU2
 *
 *    Rev 1.0   12 Sep 1991 08:04:26   amsallen
 * Initial revision.
 *
 *****************************************************************************/


/*****************************************************************************
 *
 * Header files included.
 *
 *****************************************************************************/

#include <exec.h>            /* executive information                    */
#include <kr_sfr.h>          /* KR special function registers            */
#include <kr_def.h>          /* KR definitions                           */
#include <c_regs.h>          /* KR internal register definitions         */
#include <wwslib.h>          /* world wide software definitions          */
#include "pr_s_i_s.h"        /* process system input signal information  */
#include "sysgen.h"          /* defines the task names and priority      */
#include "cont_sys.h"
#include "trns_act.h"

/*****************************************************************************
 *
 * #defines local to this file.
 *
 *****************************************************************************/

/* Start_AD_Conversions */

#define ENABLE_AD_PTS_SCAN 0X20
#define ENABLE_AD_ISR 0X20

#define PERIOD 10U                                   /* 10ms */
#define RKM_PERIOD 50U                               /* 50ms */


/*****************************************************************************
 *
```

```
 * Constants and variables declared by this file.
 *
 ******************************************************************************/
/* Digital Inputs on Port1 */

uchar splitter_select_switch;
uchar intent_to_shift_switch;
uchar intent_hold;
uchar intent_hold_timer;
uchar range_select_switch;
uchar in_gear_switch;
uchar splitter_launch_state;
uchar clutch_state;

/* Analog Inputs on Port0 */

int ignition_volts;
int splitter_position;

#define IGNITION_VOLTS_CHANNEL_RESULT   1
#define SPLITTER_POS_CHANNEL_RESULT    15

#define CONVERSION_TIME 0xef            /* for state time = 125 nsec:     */
                                        /*    sample time = 3.6250 usec   */
                                        /*    convert time = 20.1875 usec */
#define CONVERT_8 8                     /* scan and convert 8 channels    */

#define CONVERT_IGNITION_VOLTS          (_NORM_MODE|_10_BIT_MODE|_STRT_CONV|_CHNL_0)
#define UNUSED_CHANNEL_1                (_NORM_MODE|_10_BIT_MODE|_STRT_CONV|_CHNL_1)
#define UNUSED_CHANNEL_2                (_NORM_MODE|_10_BIT_MODE|_STRT_CONV|_CHNL_2)
#define UNUSED_CHANNEL_3                (_NORM_MODE|_10_BIT_MODE|_STRT_CONV|_CHNL_3)
#define UNUSED_CHANNEL_4                (_NORM_MODE|_10_BIT_MODE|_STRT_CONV|_CHNL_4)
#define UNUSED_CHANNEL_5                (_NORM_MODE|_10_BIT_MODE|_STRT_CONV|_CHNL_5)
#define UNUSED_CHANNEL_6                (_NORM_MODE|_10_BIT_MODE|_STRT_CONV|_CHNL_6)
#define CONVERT_SPLITTER_POS            (_NORM_MODE|_10_BIT_MODE|_STRT_CONV|_CHNL_7)
#define STOP_CONVERSION                 0x00
#define START_CONVERSIONS               _ad_command = CONVERT_IGNITION_VOLTS

/* table containing AD_result and AD_Command values after PTS scan */
unsigned int AD_Table[16];

/* AD SCAN PTS CONTROL BLOCK LOCATION */
_ad_ptsb_type AD_Con_Block;
#pragma locate(AD_Con_Block=0x01F8)     /* locate pts control block */
#pragma pts(AD_Con_Block = 5)           /* set pts vector 5, A/D done */


#pragma EJECT
```

```
/*************************************************************************
 *
 * Function:  Initialize_Input_Signals
 *
 * Description:
 *    This routine initializes the A/D converter.  It sets the A/D to
 *    run in PTS scan mode, 10bit conversion. The PTS control block is
 *    set up and the Command/result table is initialized.
 *
 *************************************************************************/

void Initialize_Input_Signals(void)
{
   /* if we knew when the first speed packet arrived, we could initialize
      with those values.  since we don't, be safe and use zero. */

   AD_Table[0]  = UNUSED_CHANNEL_1;          /* place holder for channel 1     */
   AD_Table[1]  = 0x0000;                    /* IGNITION_VOLTS_CHANNEL_RESULT  */
   AD_Table[2]  = UNUSED_CHANNEL_2;          /* place holder for channel 2     */
   AD_Table[3]  = 0x0000;                    /* UNUSED_1_RESULT                */
   AD_Table[4]  = UNUSED_CHANNEL_3;          /* place holder for channel 3     */
   AD_Table[5]  = 0x0000;                    /* UNUSED_2_RESULT                */
   AD_Table[6]  = UNUSED_CHANNEL_4;          /* place holder for channel 4     */
   AD_Table[7]  = 0x0000;                    /* UNUSED_3_RESULT                */
   AD_Table[8]  = UNUSED_CHANNEL_5;          /* place holder for channel 5     */
   AD_Table[9]  = 0x0000;                    /* UNUSED_4_RESULT                */
   AD_Table[10] = UNUSED_CHANNEL_6;          /* place holder for channel 6     */
   AD_Table[11] = 0x0000;                    /* UNUSED_5_RESULT                */
   AD_Table[12] = CONVERT_SPLITTER_POS;      /* Command convert splitter pos   */
   AD_Table[13] = 0x0000;                    /* UNUSED_6_RESULT                */
   AD_Table[14] = STOP_CONVERSION;           /*  command to Stop conversions   */
   AD_Table[15] = 0x0000;                    /* SPLITTER_POS_CHANNEL_RESULT    */

   AD_Con_Block.cnt = CONVERT_8;
   AD_Con_Block.ctrl = _AD_MODE|_S_D_UPDT;   /* A/D mode bits 0,1 of PTS_CONTROL */
                                             /* always set to 3h bit 2 = 0       */
                                             /* S/D update at end of cycle       */
                                             /* bit 5 always 0                   */
                                             /* Set mode for AD SCAN             */

   AD_Con_Block.s_d = AD_Table;              /* Load s_d with AD_Table address   */
   AD_Con_Block.reg = (void *)&_ad_result;   /* Load reg with AD_Result address  */

   _ad_time = CONVERSION_TIME;
   _ad_test = _NO_OFFS;                      /* Disable test mode */
   _pts_select &= ~(_PTS_ADDONE_BIT);        /* Disable AD PTS */

}


#pragma EJECT
```

```
/*************************************************************************
 *
 * Function:  AD_ISR
 *
 * Description:
 *    This interupt service routine resets the PTSCOUNT, pts_sd and pts_reg
 *    for another PTS_Scan A/D cycle. It also readies a task to run when
 *    a PTS cycle has completed.
 *
 *************************************************************************/

#pragma interrupt(AD_ISR=5)
void AD_ISR(void)
{
   x_start_isr();
   AD_Con_Block.cnt = CONVERT_8;          /* Reset pts count for next cycle */
   AD_Con_Block.s_d = AD_Table;           /* Reset table pointer to start of table */
   AD_Con_Block.reg = (void *)&_ad_result;

   x_ready(PROCESS_INPUT_SIGNALS);        /* Ready pr_s_i_s task */
   x_end_isr();
}


#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  Start_AD_Conversions
 *
 * Description:
 *    This function initializes the input signal processing function
 *    if it has not already been done, and then startes the PTS Scan
 *    of the AD channels by sending the appropriate command to the
 *    ad_command register.
 *
 *****************************************************************************/

void Start_AD_Conversions(void)
{
   if ((_int_mask & ENABLE_AD_ISR) == 0 )
      Initialize_Input_Signals();            /* Set up AD table for PTS */

   _pts_select |= ENABLE_AD_PTS_SCAN;
   _int_mask |= ENABLE_AD_ISR;

   x_prearm_stimulus();

   START_CONVERSIONS;   /* Start a conversion, initiate the PTS cycles */

   x_wait_stimulus();   /* AD_ISR will ready task when PTS is complete */
}

#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  read_switch_inputs
 *
 * Description:
 *    Read the state of the digital inputs.
 *
 *****************************************************************************/

void read_switch_inputs(void)
{

   if (port_1_switches & 0x1)      /* P1.0 */
     in_gear_switch = TRUE;
   else
     in_gear_switch = FALSE;

   if (port_1_switches & 0x2)      /* P1.1 */
     range_select_switch = LOW;
   else
     range_select_switch = HIGH;

   if (R747_type == INTENT)
   {
     if (port_1_switches & 0x4)      /* P1.2 */
     {
       intent_to_shift_switch = FALSE;

       if (intent_hold_timer < 25)
         intent_hold_timer += 1;
       else
         intent_hold = FALSE;
     }
     else
     {
       intent_to_shift_switch = TRUE;
       intent_hold_timer = 0;
     }
   }

   else
   {
     if (port_1_switches & 0x4)      /* P1.2 */
       splitter_select_switch = HIGH;
     else
       splitter_select_switch = LOW;
   }

   if ((port_2_switches & 0x30) == (0x10))
     clutch_state = ENGAGED;
   else
     clutch_state = DISENGAGED;

#if (0)
   if (port_1_switches & 0x4)
     splitter_launch_state = LO_SPLITTER;
   else
     splitter_launch_state = HI_SPLITTER;
#endif

     splitter_launch_state = LO_SPLITTER;

}


#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  process_input_signals
 *
 * Description:
 *   This is the periodic task which starts the analog conversions on Port0.
 *
 *****************************************************************************/

void process_input_signals(void)
{

   intent_hold = FALSE;    /* initialize intent_hold  */

   x_start_periodic();
   while (1)
   {
      read_switch_inputs();

      Start_AD_Conversions();

      /* Clean up and scale AD values */
      ignition_volts = scale_system_ad_inputs(IGNITION_VOLTAGE);
      splitter_position = scale_system_ad_inputs(SPLITTER_POSITION);

      x_sync_periodic(PERIOD*1000);
/*    x_sync_periodic(RKM_PERIOD*1000);  */
   }
   x_end_periodic();
}

#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  scale_system_ad_inputs
 *
 * Description:
 *    This function removes the channel, status and reserved bits from
 *    the raw AD values, and performs all necessary scaling and error
 *    checking for the analog inputs on Port0.
 *
 *****************************************************************************/

int scale_system_ad_inputs(char Channel)
{
   int Scaled_Value = 0;
   uint volts_per_bit;     /* BIN 16 */
   uint units_per_bit;     /* BIN 16 */
  /* #define TWELVE_VOLT_FULL_SCALE          22.46 */  /* ECU_8 volts */
   #define TWELVE_VOLT_FULL_SCALE          34.51   /* ECU_2 volts */
   #define TWENTY_FOUR_VOLT_FULL_SCALE     40.49   /* volts */
   #define DISTANCE_FULL_SCALE             100     /*       */


   volts_per_bit = (uint)((TWELVE_VOLT_FULL_SCALE*65536/1023)+0.5);
   units_per_bit = (uint)((DISTANCE_FULL_SCALE*65536/1023)+0.5);

   switch (Channel)
   {
   case 0: /* IGNITION VOLTAGE */
      _cx = AD_Table[IGNITION_VOLTS_CHANNEL_RESULT] >> 6;
      asm mulu _cxdx, volts_per_bit;   /* volts, BIN 16 (_dx, BIN 0) */
      Scaled_Value = *(int *)&_dx;
      break;

   case 1: /* UNUSED */  /* to be completed when a product requires it */
      Scaled_Value = (0);
      break;

   case 2: /* UNUSED */  /* to be completed when a product requires it */
      Scaled_Value = (0);
      break;

   case 3: /* UNUSED */  /* to be completed when a product requires it */
      Scaled_Value = (0);
      break;

   case 4: /* UNUSED */  /* to be completed when a product requires it */
      Scaled_Value = (0);
      break;

   case 5: /* UNUSED */  /* to be completed when a product requires it */
      Scaled_Value = (0);
      break;

   case 6: /* UNUSED */  /* to be completed when a product requires it */
      Scaled_Value = (0);
      break;

   case 7: /* SPLITTER POSITION */
      _cx = AD_Table[SPLITTER_POS_CHANNEL_RESULT] >> 6;
      asm mulu _cxdx, units_per_bit;   /* distance, BIN 16 (_dx, BIN 0) */
      Scaled_Value = *(int *)&_dx;
      break;

   default:
      break;
   }
   return (Scaled_Value);
}
```

```
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 *
 *****************************************************************************
 *
 * Filename:  seq_shft.c96      (R-747) (AutoSplit)
 *
 * Description:
 *    The functions in this file will perform the required system
 *    level operations for implementing Sequence Shift.
 *
 * Part Number:  <none>
 *
 *    Rev 1.2   12 Dec 1994 09:15      markyvech
 * In function "sequence_shift()" added code for the intent_hold.
 *
 *    Rev 1.1   09 Dec 1994 08:07      markyvech
 * In function "sequence_shift()" added code for the intent to shift
 * feature. This will allow shift_initiate, (predip mode), to be called.
 * Also added code to allow for the cancellation of intent to shift if
 * conditions allow, (call confirm shift).
 *
 *    Rev 1.0   12 May 1994 16:26:00   markyvech
 * Initial version
 *
 *****************************************************************************/

/*****************************************************************************
 *
 * Header files included.
 *
 *****************************************************************************/

#include <exec.h>        /* executive information */
#include <c_regs.h>      /* KR internal registers */
#include <wwslib.h>      /* World Wide Software Library */
#include "cont_sys.h"    /* control system information */
#include "conj1939.h"    /* Defines interface to engine communications info */
#include "con_o_s.h"     /* control output signal information */
#include "drl_cmds.h"    /* driveline commands information */
#include "sel_gear.h"
#include "shf_tbl.h"     /* Contains information relative to engine */
#include "trn_tbl.h"     /* transmission table information */
#include "trns_act.h"    /* transmission information */
#include "pr_s_i_s.h"    /* process system input signals information */

/*****************************************************************************
 *
 * #defines local to this file.
 *
 *****************************************************************************/

/*****************************************************************************
 *
 * publics.
 *
 *****************************************************************************/

unsigned char forced_predip_timer;
unsigned char init_dest_gear_timer;
  signed char initial_destination_gear;


/*****************************************************************************
 *
 * Constants and variables declared by this file.
 *
 *****************************************************************************/

static uchar coast_mode;      /* allows vehicle to coast in low gears */

#define FORCED_PREDIP_TIME       150   /* 300 MSEC at 5 counts per loop */
#define IN_SYNC_MODE_TIME_LIMIT  200   /*   2 SEC  */
```

```
#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  initialize_sequence_shift
 *
 * Description:
 *   This function initializes those module variables that must be set to a
 *   know state on power up or reset.
 *
 *****************************************************************************/

void initialize_sequence_shift(void)
{
   shift_type = UPSHIFT;
   shift_in_process = FALSE;
   forced_predip_timer = 0;
}


#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  shift_initiate
 *
 * Description:
 *   This function begins the shift sequence by setting up the
 *   transmission to pull to Neutral, commands the electronic engine
 *   controller to go to zero torque and prepares the clutch to disengage
 *   if required.
 *
 *****************************************************************************/

static void shift_initiate(void)
{

   /* (do not request engine fueling with engine brake on) */
   eng_brake_command = ENG_BRAKE_OFF;      /* eng brake: zero torque */

   if ((lpf_output_speed < shf_tbl.min_output_spd) ||

      (clutch_state == DISENGAGED) ||

      ((coast_mode) && (shift_type != UPSHIFT) &&     /* Prevents engine control    */
      ((destination_gear < 3) ||                      /* in low gear(s) downshifts. */
      ((destination_gear < 4) && (accelerator_pedal_position <= 5)))))
   {
     engine_commands = ENGINE_FOLLOWER;
   }
   else
   {
     engine_commands = ENGINE_PREDIP;      /* engine: bring torque to zero */
     coast_mode = FALSE;
   }
}

#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  synchronize_gear
 *
 * Description:
 *   This function assists the sychronizing of the transmission by
 *   utilizing SAE J1939 functions to control an electronic engine.
 *
 *****************************************************************************/

static void synchronize_gear(void)
{

   /* turn on engine brakes (J1939) if engine brake assisted shift is requested */

   if (eng_brake_assist)
      eng_brake_command = ENG_BRAKE_FULL;
   else
      eng_brake_command = ENG_BRAKE_OFF;

   if ((lpf_output_speed < shf_tbl.min_output_spd) ||

      (clutch_state == DISENGAGED) ||

      ((coast_mode) && (shift_type != UPSHIFT) &&     /* Prevents engine control    */
      ((destination_gear < 3) ||                      /* in low gear(s) downshifts. */
      ((destination_gear < 4) && (accelerator_pedal_position <= 5)))))
   {
     engine_commands = ENGINE_FOLLOWER;
   }

   else
   {
     engine_commands = ENGINE_SYNC;
     coast_mode = FALSE;
   }


   if ((engine_status != ENGINE_SYNC_MODE) &&
       (engine_commands == ENGINE_SYNC))
     init_dest_gear_timer = 0 ;

   if (init_dest_gear_timer < 8)                              /* Save the initial gear    */
   {                                                          /* to check for a new one   */
     initial_destination_gear = destination_gear_selected;    /* as the shift progresses. */
     init_dest_gear_timer++;
   }

   else
     if ((engine_status == ENGINE_SYNC_MODE) &&                  /* If the gear changes,  */
         (initial_destination_gear != destination_gear_selected))  /* force the predip mode */
     {                                                           /* to allow the splitter */
       forced_predip_timer = FORCED_PREDIP_TIME;                 /* to move.              */
       forced_predip = TRUE;
     }
}

#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  confirm_shift
 *
 * Description:
 *   This function finishes the shift; shift_in_process is set FALSE.
 *
 *****************************************************************************/

static void confirm_shift(void)
{
   engine_commands = ENGINE_RECOVERY;       /* engine: finish torque return */
   eng_brake_command = ENG_BRAKE_OFF;       /* eng brake: zero torque */
   shift_in_process = FALSE;
   coast_mode = TRUE;
}

#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  sequence_shift
 *
 * Description:
 *   This function calls the appropriate procedures to perform the
 *   operations of Sequence_Shift depending on the current state of
 *   the shift process.
 *
 *****************************************************************************/

void sequence_shift(void)
{

   if (destination_gear < last_known_gear)   /* determine shift type */
   {
     if (pct_demand_at_cur_sp > 5)
       shift_type = POWER_DOWN_SHIFT;
     else
       shift_type = COAST_DOWN_SHIFT;
   }
   else
     shift_type = UPSHIFT;

  if ((forced_predip_timer >= 4) &&  /* Time out a forced return to the predip mode */
      (g_ptr == 0))                  /* if the destination gear selected changes    */
    forced_predip_timer -= 4;        /* during the sync mode.                       */

  if (forced_predip_timer > 0)
    forced_predip_timer--;

  if (destination_gear == NULL_GEAR)  /* System has reset: do not start a shift */
  {
    engine_commands = ENGINE_FOLLOWER;
    eng_brake_command = ENG_BRAKE_IDLE;
  }

  else
    if ((transmission_position == OUT_OF_GEAR) &&
        (forced_predip_timer == 0) &&
       ((engine_status == ENGINE_SYNC_MODE) ||
        (engine_status == ENGINE_PREDIP_MODE))) /* forces shift_initiate() */
    {
      synchronize_gear();
    }

    else
      if ((((engine_status == ENGINE_SYNC_MODE) ||
            (engine_status == ENGINE_RECOVERY_MODE)) &&
            (forced_predip_timer == 0) &&
            (destination_gear == current_gear) &&
            (transmission_position == IN_GEAR)) ||

           ((shift_in_process == TRUE) &&          /* cancel intent to shift if */
            (intent_to_shift_switch == FALSE) &&   /* conditions allow it.      */
            (shift_init_type == MANUAL) &&
            (automatic_sip == 0) &&
            (transmission_position == IN_GEAR) &&
            (engine_status == ENGINE_PREDIP_MODE)))
      {
        confirm_shift();
      }

      else
        if (((destination_gear != current_gear) &&      /* auto splitter */
            (low_speed_latch == FALSE) &&
            (automatic_sip != 0) &&
            (transmission_position == IN_GEAR)) ||

           ((intent_to_shift_switch == TRUE) &&            /* Allows for intent_to_shift */
            (desired_gear != destination_gear_selected) &&  /* manual shift.              */
            (intent_hold == FALSE) &&
            (automatic_sip == 0) &&
            (shift_init_type == MANUAL) &&
            (low_speed_latch == FALSE) &&
            (transmission_position == IN_GEAR))  ||

            (forced_predip_timer > 0)  ||            /* gear changed during shift */
```

```
    ((transmission_position == OUT_OF_GEAR) &&  /* manual shift */
     (low_speed_latch == FALSE)))
  {
    shift_initiate();
  }
}
```

```
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 *
 *****************************************************************************
 *
 * Filename:  sel_gear.c96     (R-747) (AutoSplit)
 *
 * Description:
 *   This module is the periodic task "select_gear".  It assigns values
 *   to destination_gear_selected as a function of selected_mode, input
 *   and output shaft speeds.
 *   Shift parameters are in the data structure shf_tbl.
 *
 * Part Number:  <none>
 *
 *    Rev 1.1   12 Dec 1994 08:05      markyvech
 * In function "determine_manual_shift_pts()", changed auto_up_rpm from
 * 1350 RPM to 1425 RPM because the transmission has been changed to a "8"
 * ratio and skip upshifts need to be avoided.
 *
 *    Rev 1.0   14 Sep 1994 14:02:00   markyvech
 * Initial revision.
 *
 *****************************************************************************/

/*****************************************************************************
 *
 * Header files included.
 *
 *****************************************************************************/

#include <exec.h>          /* executive information */
#include <c_regs.h>        /* c registers */
#include <wwslib.h>        /* contains common global defines */
#include "cont_sys.h"      /* control system */
#include "conj1939.h"      /* defines interface to j1939 control module */
#include "drl_cmds.h"      /* driveline commands information */
#include "sel_gear.h"      /* select gear */
#include "shf_tbl.h"       /* shift table definition */
#include "trn_tbl.h"       /* (system) transmission table definition */
#include "calc_spd.h"
#include "trns_act.h"
#pragma noreentrant

/*****************************************************************************
 *
 * #defines local to this file.
 *
 *****************************************************************************/

#define US_PER_LOOP 40000U

#define INITIAL_START_GEAR 1

#define SHIFT_INHIBIT_DECEL_LIMIT -150

/*****************************************************************************
 *
 * Constants and variables declared by this file.
 *
 *****************************************************************************/

/* public */

 char  destination_gear_selected;
 char  destination_gear;
 char  flash_desired_allowed;
 char  desired_gear;
 char  desired_gear_dn;
 char  desired_gear_up;
uchar  coasting_latch;
uchar  shift_init_type;
uint   lpf_output_speed;
```

```
int   dos_predicted;              /* BIN 0 */
int   dos_prdtd_lim_no_jake;      /* BIN 0 */


/* local */

/* filter weights for the "mda" output speed filter */
static register uchar w1;
static register uchar w2;
static register uchar w3;
static register uchar w4;

/* shift table (define and extern in shf_tbl.h) */
struct shf_tbl_t shf_tbl;

/* default shift table values */
const struct shf_tbl_t ini_shf_tbl =
{
   1200,              /* aut_dwn_rpm */
   1000,              /* aut_min_dwn_rpm */
   1700,              /* aut_up_rpm */
   0,                 /* best_gr_offset */
   50,                /* dwn_offset_rpm */
   100,               /* dwn_reset_rpm */
   400,               /* dwn_timer_offset_rpm */
   40,                /* hysteresis_rpm */
   1850,              /* man_dwn_sync_rpm */
   700,               /* man_up_sync_rpm */
   1900,              /* rated_rpm */
   150,               /* up_offset_rpm */
   125,               /* up_reset_rpm */
   200,               /* up_timer_offset_rpm */
   0,                 /* dwn_accel */
   8,                 /* up_accel */
   3000,              /* offset_time */
   (uint)(0.25*256),  /* aut_up_pct */
   10,                /* min_output_spd */
   1,                 /* max_start_gear */
   0,                 /* padbyte1 */

   196,               /* k1_ability, min-ft/rev-sec, BIN 12 */
   431,               /* axle_ratio_cal, BIN 7 */
   383,               /* gcw_k1, rev/sec-min-ft, BIN 0 */
   2437,              /* gcw_k2, rev/sec^2, BIN 7 */
   1325,              /* calc_start_point, rpm, BIN 0 */

   107,               /* k6_ability, min-lb-ft-sec/rev, BIN 8 */
   1500,              /* auto_up_lo_base, rpm, BIN 0 */
   1100,              /* auto_dn_lo_base, rpm, BIN 0 */
   100,               /* auto_rtd_offset, rpm, BIN 0 */
   1000,              /* lowest_engage_rpm, BIN 0 */
   0,                 /* padword1 */
   0                  /* padword2 */
};


/* local -- initialized at start of task by select_gear */

/* shift points with anti-hunt offsets; referenced by auto_downshift and
   auto_upshift; set by get_automatic_gear and select_gear */
uint upshift_point;
uint downshift_point;

/* lower limit for gear selections */
char lowest_forward;

/* indicate direction of a get_automatic_gear shift; referenced by
   get_manual_gear; cleared by select_gear when shift complete */
char automatic_sip;

/* used in the determination of shift_points based on throttle position */
static uint auto_up_rpm;
static uint auto_dn_rpm;
static uint auto_up_offset_rpm;
static uint auto_dn_offset_rpm;

/* delay counter for anti-hunt */
static uchar antihunt_counter;

/* gross combined weight calculations */
```

```
#define ZERO_SPEED_TIME_LIMIT   4500  /* 3 min @ 0.040 period */
#define VALID_OLD_DATA_TIME      100  /* 4 sec @ 0.040 period */
#define MAX_VEHICLE_WEIGHT    100000  /* 100,000 lbs */
#define DOS_OFFSET_INIT           48
#define ENG_DECEL_LOW_LIMIT     -350  /* rpm/s */
#define ENG_DECEL_LPF            224  /* exp(-2pi(0.53Hz)(0.040s)) = 0.875 (BIN 8) */

#if (0)
static ulong  gross_combined_weight;
static long   gcw_local;
static uint   gcw_local_counter;
static ulong  gcw_local_total;
static uchar  valid_old_data_counter;
static uchar  missed_shift_offset_arm;
static uchar  gcw_calculation_allowed;
static uint   zero_speed_counter;
static uchar  gcw_first_shift;
static uchar  dos_filter_latch;
static uint   gcw_cal_new;              /* lb-sec^2, BIN 0 */
static int    dos_filtered_old;
static int    dos_offset;
static uint   sync_delta_timer;
static uchar  dis_filter_latch;
static uint   input_spd_first_point;
static int    eng_decel_latest;
static int    eng_decel_rate;
static int    eng_decel_rate_wth_jake;
static uchar  used_eng_brk;

/* shiftability calculations */

#define TORQ_ACC_LPF         230      /* 0.9000 BIN 8 */
#define K7_ABILITY           249      /* 0.9730 BIN 8 */
#define FIXED_LIMIT          -30
#define FIXED_LIMIT_1        -36
#define SHF_BLY_HOLD_COUNT     3      /* 120 ms @ 0.040 period */

static uchar shiftability_hold;
static uchar shiftability_hold_II;
static uchar shf_bly_hold_cntr;
static int dos_predicted_raw;          /* BIN 0 */
static long dos_predicted_bin8;        /* BIN 8 */
static long dos_predicted_partial_1;   /* BIN 8 */
static long dos_predicted_partial_2;   /* BIN 8 */
static int dos_prdtd_lim_wth_jake;     /* BIN 0 */
static int vehicle_accel_bs;           /* BIN 0 */
static int vehicle_accel_as;           /* BIN 0 */
static int engine_torque;              /* BIN 0 */
static int torque_at_wheels;           /* BIN 0 */
static int torq_to_accel_eng;          /* BIN 0 */
static uint gcw_cal;                   /* lb-sec^2, BIN 0 */
static uint TRANS_STEP_SIZE_CAL;       /* #, BIN 8 */
static uchar torque_accessories;       /* lb-ft, BIN 0 */
#endif

#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function: mda_output_filter
 *
 * Description:
 *      This is a one pole LPF with a variable coefficient.  The magnitude
 *      of the coefficient is directly related to the acceleration content
 *      of the speed sample and the frequency.
 *
 *****************************************************************************/

static void mda_output_filter(void)
{
   #define K1 8
   #define K2 24
   #define K3 48
   #define K4 160

   static register uint os_delta_speed;
   static register uchar weight;

   if (lpf_output_speed > output_speed)
      os_delta_speed = lpf_output_speed - output_speed;
   else
      os_delta_speed = output_speed - lpf_output_speed;

      if (os_delta_speed <= K1)         /* delta <= 200 rpm/s */
      {
         if (w1 > 1) --w1;
         if (w2 < 5) ++w2;
         if (w3 < 6) ++w3;
         if (w4 < 7) ++w4;
         weight = w1;
      }
      else if (os_delta_speed <= K2)   /* 200 rpm/s < delta <= 600 rpm/s */
      {
         if (w1 < 4) ++w1;
         if (w2 > 2) --w2;
         if (w3 < 6) ++w3;
         if (w4 < 7) ++w4;
         weight = w2;
      }
      else if (os_delta_speed <= K3)   /* 600 rpm/s < delta <= 1200 rpm/s */
      {
         if (w1 < 4) ++w1;
         if (w2 < 5) ++w2;
         if (w3 > 3) --w3;
         if (w4 < 7) ++w4;
         weight = w3;
      }
      else if (os_delta_speed <= K4)   /* 1200 rpm/s < delta <= 4000 rpm/s */
      {
         if (w1 < 4) ++w1;
         if (w2 < 5) ++w2;
         if (w3 < 6) ++w3;
         if (w4 > 3) --w4;
         weight = w4;
      }
      else                              /* 4000 rpm/s < delta */
      {
         if (w1 < 4) ++w1;
         if (w2 < 5) ++w2;
         if (w3 < 6) ++w3;
         if (w4 < 7) ++w4;
         weight = 7;
      }

   lpf_output_speed = lpf_output_speed +
      (output_speed >> weight) - (lpf_output_speed >> weight);
}

#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  new_input_speed
 *
 * Description:
 *      A utility function that returns the input shaft speed expected if
 *      "gear" was engaged with the present output shaft speed.
 *
 *****************************************************************************/

static uint new_input_speed(char gear)
{
   /* new_input_speed = lpf_output_speed * gear_ratio */
   _ax = trn_tbl.gear_ratio[gear + GR_OFS];      /* BIN 8 */
   asm mulu _axbx, lpf_output_speed;             /* BIN 0+8=8 (_axbx) */
   asm shrl _axbx, #8;                           /* BIN 8>>=0 (_ax) */
   return _ax;
}

#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  auto_upshift
 *
 * Description:
 *   This boolean function returns true when automatic upshift
 *   conditions have been met.
 *
 *****************************************************************************/

static int auto_upshift(void)
{
   if ((gos > upshift_point) && (output_speed_filtered > 120))
   {
     if (engine_communication_active)
     {
           /* if ((!shiftability_hold) && (!shiftability_hold_II)) */
           return 1;
     }
   }
   return 0;
}

#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  auto_downshift
 *
 * Description:
 *   This boolean function returns true when automatic downshift
 *   conditions have been met.
 *
 *****************************************************************************/

static int auto_downshift(void)
{
   if (gos < downshift_point)
   {
     return 1;
   }
   return 0;
}
#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  determine_autosplit_type
 *
 * Description:
 *   This function is used to determine if the impending shift type is
 *   MANUAL or AUTO.
 *
 *****************************************************************************/

static char determine_autosplit_type(char passed_new_gear, char passed_initial_gear)
{
   register char new_gr = passed_new_gear;
   register char init_gr = passed_initial_gear;

   if ((shift_in_process == FALSE) || (engine_status == ENGINE_RECOVERY_MODE))
   {
     if ((new_gr ==  1 && init_gr ==  2) ||  /* dn */
         (new_gr ==  3 && init_gr ==  4) ||  /* dn */
         (new_gr ==  5 && init_gr ==  6) ||  /* dn */
         (new_gr ==  7 && init_gr ==  8) ||  /* dn */
         (new_gr ==  9 && init_gr == 10) ||  /* dn */
         (new_gr == 10 && init_gr ==  9) ||  /* up */
         (new_gr ==  8 && init_gr ==  7) ||  /* up */
         (new_gr ==  6 && init_gr ==  5) ||  /* up */
         (new_gr ==  4 && init_gr ==  3) ||  /* up */
         (new_gr ==  2 && init_gr ==  1))   /* up */
       shift_init_type = AUTO;

     else
       shift_init_type = MANUAL;
   }

}

#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  get_automatic_gear
 *
 * Description:
 *   This function determines the appropriate gear for both automatic
 *   splitter shifts and manual lever shifts.
 *
 *****************************************************************************/

static char get_automatic_gear(char initial_gear, char manual_request)
{
   register char new_gear = initial_gear;

   if (automatic_sip != -1)
   {

      /* initiate or continue an upshift: search up from lowest_forward
         (fastest input speed) for the first available gear that will provide input
         speed below a value (approx upshift rpm, minus an offset for gears that will
         result in a net downshift) */
      for (new_gear = lowest_forward;
         (new_input_speed(new_gear) > (upshift_point -
            (new_gear < initial_gear ?
               (shf_tbl.up_offset_rpm + auto_dn_offset_rpm)   : shf_tbl.best_gr_offset)))
         && (new_gear < trn_tbl.highest_forward);
         ++new_gear)
         ;

      if ((initial_gear == 3) && ((new_gear == 2) || (new_gear == 1)))
         new_gear = initial_gear;

      desired_gear = new_gear;
      desired_gear_up = new_gear;
      determine_autosplit_type(new_gear, initial_gear);

      /* if lever shift and still in gear, keep initial_gear */
      if (((shift_init_type == MANUAL) && (transmission_position == IN_GEAR)) ||

          ((automatic_sip == 0) && (new_gear <= initial_gear)) ||

          ((dgos < SHIFT_INHIBIT_DECEL_LIMIT) &&
          ((transmission_position == IN_GEAR) ||
          ((transmission_position == OUT_OF_GEAR) && (shift_init_type == AUTO)))))
         new_gear = initial_gear;
      else
      {
         /* indicate gear change and adjust downshift_point */
         automatic_sip = +1;
         auto_up_offset_rpm = 0;
         if (shift_init_type == AUTO)
           auto_dn_offset_rpm = shf_tbl.dwn_timer_offset_rpm;
         else
           auto_dn_offset_rpm = 0;
      }
   }


   if ((automatic_sip != 1) && (initial_gear > lowest_forward))
   {
      /* initiate or continue an downshift:  search down from
         highest_forward (slowest input speed) for the first available gear that will
         provide input speed above a value (approx downshift rpm, plus an offset for
         gears that will result in a net upshift) */
      for (new_gear = trn_tbl.highest_forward;
         (new_input_speed(new_gear) < (downshift_point +
            (new_gear > initial_gear ? shf_tbl.dwn_offset_rpm : shf_tbl.best_gr_offset)))
         && (new_gear > lowest_forward);
         --new_gear)
         ;

      if ((initial_gear == 3) && ((new_gear == 2) || (new_gear == 1)))
         new_gear = initial_gear;

      desired_gear_dn = new_gear;

      if (desired_gear_dn < initial_gear)  /* Must be a down shift or else it may  */
        desired_gear = new_gear;           /* wrongly cancel the desired_up pick.  */
```

```
      determine_autosplit_type(new_gear, initial_gear);

      /* if lever shift and still in gear, keep initial_gear */
      if (((shift_init_type == MANUAL) && (transmission_position == IN_GEAR)) ||

          ((automatic_sip == 0) && (new_gear >= initial_gear)) ||

          ((dgos < SHIFT_INHIBIT_DECEL_LIMIT) &&
          ((transmission_position == IN_GEAR) ||
          ((transmission_position == OUT_OF_GEAR) && (shift_init_type == AUTO)))))
        new_gear = initial_gear;
      else
      {
         /* indicate automatic gear change and adjust upshift_point */
         automatic_sip = -1;
         auto_dn_offset_rpm = 0;
         if (shift_init_type == AUTO)
           auto_up_offset_rpm = shf_tbl.up_timer_offset_rpm;
         else
           auto_up_offset_rpm = 0;
      }
   }
   return new_gear;
}

#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  determine_destination
 *
 * Description:
 *    This function uses "coasting_latch" to determine if a coasting or
 *    skip shift is being attempted.  When sensed, the latch is used in
 *    the determine_base_pts function to affect the base shift points.
 *
 *****************************************************************************/

void determine_destination(void)
{

   /* if coasting in neutral - modify shift points */

   if (coasting_latch == FALSE)
   {
     if ((last_known_gear - destination_gear_selected) > 1) /* multi downshift */
     {
       if ((destination_gear_selected == 7) ||
           (destination_gear_selected == 5) ||
           (destination_gear_selected == 3) ||
           (destination_gear_selected == 1))
       {
         destination_gear_selected++;
         coasting_latch = TRUE;
       }
     }
     else
     {
       if ((destination_gear_selected - last_known_gear) > 1) /* multi upshift */
       {
         if ((destination_gear_selected == 10) ||
             (destination_gear_selected ==  8) ||
             (destination_gear_selected ==  6) ||
             (destination_gear_selected ==  4))
         {
           destination_gear_selected--;
           coasting_latch = TRUE;
         }
       }
     }
   }
   else
    if (shift_in_process == FALSE)
      coasting_latch = FALSE;

}

#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  determine_manual_shift_pts
 *
 * Description:
 *
 *****************************************************************************/

static void determine_manual_shift_pts(void)
{

   if (coasting_latch == FALSE)
   {
     if ((last_known_gear == 1) ||
         (last_known_gear == 3) ||
         (last_known_gear == 5) ||
         (last_known_gear == 7) ||
         (last_known_gear == 9))
       auto_dn_rpm = 1325;      /* manual downshifts */

     else
       auto_up_rpm = 1425;      /* manual upshifts */
   }

}
#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  determine_base_auto_shift_pts
 *
 * Description:
 *   This function determines the base up and down shift points based on
 *   the position of the throttle.  These base points will be used in the
 *   calculation of the upshift_point and the downshift_point.
 *
 *   The anti-hunting calculations have been moved to this function since
 *   these calculations are now throttle dependent.
 *
 *****************************************************************************/

static void determine_base_auto_shift_pts(void)
{

   if (pct_demand_at_cur_sp > 0)
   {
      /* auto_up_rpm = shf_tbl.auto_up_lo_base +
            ((shf_tbl.aut_up_rpm - shf_tbl.auto_up_lo_base) * %throttle) */

      _cx = shf_tbl.aut_up_rpm - shf_tbl.auto_up_lo_base;
      _bx = pct_demand_at_cur_sp;
      asm mulu _cxdx, _bx;
      asm divu _cxdx, #100;
      auto_up_rpm = shf_tbl.auto_up_lo_base + _cx;

      /* check for RTD requirement */
      if (pct_demand_at_cur_sp > 90)
         auto_up_rpm += shf_tbl.auto_rtd_offset;

      /* auto_dn_rpm = shf_tbl.auto_dn_lo_base +
            ((shf_tbl.aut_dwn_rpm - shf_tbl.auto_dn_lo_base) * %throttle) */

      _cx = shf_tbl.aut_dwn_rpm - shf_tbl.auto_dn_lo_base;
      _bx = pct_demand_at_cur_sp;
      asm mulu _cxdx, _bx;
      asm divu _cxdx, #100;
      auto_dn_rpm = shf_tbl.auto_dn_lo_base + _cx;
   }
   else
   {
      auto_up_rpm = shf_tbl.auto_up_lo_base;
      auto_dn_rpm = shf_tbl.auto_dn_lo_base;
   }

   determine_manual_shift_pts();

   if (shift_in_process)
   {
      /* reset antihunt_counter */
      antihunt_counter = 0;

      /* allow the knob display to flashed any new desired gear */
      flash_desired_allowed = TRUE;
   }
   else
   {
      /* reset shift in process flags and update antihunt_counter */
      automatic_sip = 0;
      if (antihunt_counter < 255)
      {
         ++antihunt_counter;
      }

      /* look for upshift anti-hunt reset conditions */
      if ((antihunt_counter * (US_PER_LOOP/1000)) >= shf_tbl.offset_time)
      {
         /* check for last shift = upshift effects */
         if (auto_dn_offset_rpm == shf_tbl.dwn_timer_offset_rpm)
            auto_dn_offset_rpm = shf_tbl.dwn_offset_rpm;
         else if ((auto_dn_offset_rpm == shf_tbl.dwn_offset_rpm) &&
            (input_speed_filtered > auto_dn_rpm + shf_tbl.dwn_reset_rpm))
            auto_dn_offset_rpm = 0;

         /* check for last shift = downshift effects */
         if (auto_up_offset_rpm == shf_tbl.up_timer_offset_rpm)
            auto_up_offset_rpm = shf_tbl.up_offset_rpm;
```

```
        else if ((auto_up_offset_rpm == shf_tbl.up_offset_rpm) &&
           (input_speed_filtered > auto_up_rpm - shf_tbl.up_reset_rpm))
           auto_up_offset_rpm = 0;

        /* allow the knob display to flashed the desired gear */
        if (((desired_gear > destination_gear_selected) && (gos < (upshift_point + 25))) ||
            ((desired_gear < destination_gear_selected) && (gos > (downshift_point - 25))))
          flash_desired_allowed = FALSE;
        else
          flash_desired_allowed = TRUE;
      }
   }

   /* set the shift points based on throttle and determined offsets */
   upshift_point = auto_up_rpm + auto_up_offset_rpm;
   downshift_point = auto_dn_rpm - auto_dn_offset_rpm;

   /* check that the calculated shift point is reasonable */
   if (upshift_point > shf_tbl.man_dwn_sync_rpm)
      upshift_point = shf_tbl.man_dwn_sync_rpm;

   if (downshift_point < shf_tbl.man_up_sync_rpm)
      downshift_point = shf_tbl.man_up_sync_rpm;

}

#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  select_gear
 *
 * Description:
 *      This is the root function for the periodic task SELECT_GEAR.  Each
 *      loop begins by checking the manual up/down buttons.  Then, based on
 *      selected_mode and output shaft speed, a 'get_..._gear' function is
 *      called to update destination_gear_selected.
 *
 *****************************************************************************/

void select_gear(void)
{
   char manual_request;              /* current manual request (+/- 1) */
   static uchar enable_gcw_calc;     /* diagnostic - delete later !!*/

   enable_gcw_calc = FALSE;          /* diagnostic - delete later !!*/

   shf_tbl = ini_shf_tbl;            /* initialize the shift table */

   destination_gear_selected = 1;
   desired_gear = 1;

   /* initialize file scope variables */

   w1 = 3;
   w2 = 4;
   w3 = 5;
   w4 = 6;
   lpf_output_speed = output_speed;

   upshift_point = shf_tbl.aut_up_rpm;
   downshift_point = shf_tbl.aut_dwn_rpm;
   auto_up_offset_rpm = shf_tbl.up_timer_offset_rpm;
   auto_dn_offset_rpm = shf_tbl.dwn_timer_offset_rpm;
   lowest_forward = INITIAL_START_GEAR;
   automatic_sip = 0;
   antihunt_counter = 255U;
   coasting_latch = FALSE;
   flash_desired_allowed = TRUE;

#if (0)       /* shiftability variables */
   zero_speed_counter = ZERO_SPEED_TIME_LIMIT + 5; /* force init of gcw variables */
   eng_decel_rate = -400;   /* RPM/SEC */

   TRANS_STEP_SIZE_CAL = 346;  /* 1.352 BIN 8 (was constant) */
   torque_accessories = 100;   /* accessory load with air condition off in coach */
   gcw_cal = 2400;             /* (GCW x 1.68)/32.17 BIN 0 (was constant) */
   gcw_cal_new = 2400;         /* (GCW x 1.68)/32.17 BIN 0 (was constant) */
   gcw_local = 45000;
   gcw_local_counter = 50;
   gcw_local_total = 2250000;
   gross_combined_weight = 45000;

#endif     /* shiftability variables */

   x_start_periodic();
   while (1)
   {
      mda_output_filter();     /* update our filtered output speed */

#if (0)                         /* shiftability */
     if (enable_gcw_calc)       /* diagnostic aid !!*/
      {
        determine_gross_combined_weight();
        determine_shiftability();
        determine_shiftability_II();
      }                         /* shiftability */
#endif
      manual_request = 0;
      determine_base_auto_shift_pts();

      /* set destination_gear_selected from function(s) appropriate for selected_mode */
      switch(selected_mode)
      {
      case REVERSE_MODE:

      case DRIVE_MODE:
```

```
            if ((forward_last == TRUE) &&
                (downshift_delayed == FALSE) &&
                (low_speed_latch == FALSE))
            {
              destination_gear_selected = get_automatic_gear(destination_gear_selected, manual_request);
              determine_destination();
            }
            break;

         case LOW_MODE:
         case HOLD_MODE:
         case NEUTRAL_MODE:
         case PARK_MODE:
         case POWER_UP_MODE:
         case POWER_DOWN_MODE:
         case DIAGNOSTIC_TEST_MODE:
            /* prevent transient selection upon mode change (these modes ignore it) */
            destination_gear_selected = 0;
            break;

         default:
            /* invalid mode: do nothing */
            break;
         }
         x_sync_periodic(US_PER_LOOP);
      }
      x_end_periodic();
   }
```

```
/*****************************************************************************
 *
 *        Unpublished and confidential.  Not to be reproduced,
 *        disseminated, transferred or used without the prior
 *        written consent of Eaton Corporation.
 *
 *        Copyright Eaton Corporation, 1994.
 *        All rights reserved.
 *
 *****************************************************************************
 *
 * Filename:  trns_act.c96    (R-747) (AutoSplit)
 *
 * Description:
 *  This modules monitors and controls the transmission's actions.
 *
 * Part Number:  <none>
 *
 *    Rev 1.5  12 Dec 1994 09:19      markyvech
 * In "determine_gear" function; added condition for "intent_hold" and
 * "in_gear_switch".
 *
 *    Rev 1.4   9 Dec 1994 14:25      markyvech
 * In "determine_gear" function; added conditions that the "gear_in_timer"
 * will be held high while in the engine_sync_mode and the intent_to_shift
 * switch is depressed. (A smaller sync error is maintained for easier
 * lever engagement when the switch is depressed.)  Also changed the offset
 * for clearing the low_speed_latch from downshift_point + 100 to
 * downshift_point + 275.
 *
 *    Rev 1.3   9 Dec 1994 07:59      markyvech
 * In "determine_splitter_state_autosplit" function; added the conditions
 * to preselect the splitter if the "intent_to_shift_switch" is TRUE.
 *
 *    Rev 1.2   7 Dec 1994 15:53      markyvech
 * Added the "determine_range_state" function.  Set the appropriate range
 * solenoid select flag based on the electric range select switch.
 *
 *    Rev 1.1   5 Dec 1994 14:54      markyvech
 * Broke the "determine_splitter_state" function into multiple functions
 * based on the type of base transmission system we are working with.
 *
 *    Rev 1.0   3 May 1994 13:35:04   markyvech
 * Initial revision.
 *
 *****************************************************************************/
/*****************************************************************************
*
* Header files included.
*
*****************************************************************************/

#include <exec.h>       /* executive information */
#include <c_regs.h>     /* KR internal register definitions */
#include <kr_sfr.h>     /* defines the kr special function registers */
#include <kr_def.h>     /* 80c196kr bits, constants, and structures */
#include <wwslib.h>
#include "drl_cmds.h"   /* engine control interface */
#include "trns_act.h"   /* interface to this module */
#include "trn_tbl.h"    /* transmission table */
#include "calc_spd.h"
#include "cont_sys.h"
#include "sel_gear.h"
#include "conj1939.h"
#include "pr_s_i_s.h"

/*****************************************************************************
*
*  Variables declared by this file.
*
*****************************************************************************/

register unsigned char   transmission_position;

unsigned char   R747_type;
unsigned char   jammed_in_wrong_gear_timer;
unsigned char   manual_sync_delayed_timer;
unsigned char   low_speed_latch;
unsigned char   forward_last;
```

```
unsigned char   splitter_hi;
unsigned char   splitter_lo;
unsigned char   range_hi;
unsigned char   range_lo;
unsigned char   splitter_timer;
unsigned char   splitter_within_sync;
unsigned char   aux_box;
unsigned char   downshift_delayed;
  signed char   g_ptr_old;
  signed char   current_gear;
  signed char   last_known_gear;
unsigned int    gear_in_timer;
unsigned int    gear_out_timer;
unsigned int    normal_auto_neutral_timer;
unsigned int    abs_trans_sync_error;
unsigned int    trans_window_calc;
  signed int    input_speed_modified;
  signed int    trans_sync_error;
  signed int    range_error;
  signed int    range_cal;
  signed int    splitter_tc;
  signed long   isdgf;
  signed long   gros;
  signed char   g_ptr;

#pragma EJECT
```

```
/*****************************************************************************
*
* #defines and constants local to this file.
*
*****************************************************************************/

#define US_PER_LOOP 10000U
#define JAMMED_TIME  200        /* 2.0 SECONDS */

static const uchar SPLITTER_LO_TABLE[23] =
{
      0,      /* -4 */
      0,      /* -3 */
     ON,      /* -2 */  /* split_lo = OFF,  split_hi =  ON;  overdrive */
     ON,      /* -1 */  /* split_lo =  ON,  split_hi = OFF;  direct    */
     ON,      /*  0 */  /* split_lo =  ON,  split_hi = OFF;  direct    */
     ON,      /*  1 */  /* split_lo =  ON,  split_hi = OFF;  direct    */
     ON,      /*  2 */  /* split_lo = OFF,  split_hi =  ON;  overdrive */
     ON,      /*  3 */  /* split_lo =  ON,  split_hi = OFF;  direct    */
     ON,      /*  4 */  /* split_lo = OFF,  split_hi =  ON;  overdrive */
     ON,      /*  5 */  /* split_lo =  ON,  split_hi = OFF;  direct    */
     ON,      /*  6 */  /* split_lo = OFF,  split_hi =  ON;  overdrive */
     ON,      /*  7 */  /* split_lo =  ON,  split_hi = OFF;  direct    */
     ON,      /*  8 */  /* split_lo = OFF,  split_hi =  ON;  overdrive */
     ON,      /*  9 */  /* split_lo =  ON,  split_hi = OFF;  direct    */
     ON,      /* 10 */  /* split_lo = OFF,  split_hi =  ON;  overdrive */
      0,      /* 11 */
      0,      /* 12 */
      0,      /* 13 */
      0,      /* 14 */
      0,      /* 15 */
      0,      /* 16 */
      0,      /* 17 */
      0       /* 18 */
};

static const uchar SPLITTER_HI_TABLE[23] =
{
      0,      /* -4 */
      0,      /* -3 */
     ON,      /* -2 */  /* split_lo = OFF,  split_hi =  ON;  overdrive */
    OFF,      /* -1 */  /* split_lo =  ON,  split_hi = OFF;  direct    */
    OFF,      /*  0 */  /* split_lo =  ON,  split_hi = OFF;  direct    */
    OFF,      /*  1 */  /* split_lo =  ON,  split_hi = OFF;  direct    */
     ON,      /*  2 */  /* split_lo = OFF,  split_hi =  ON;  overdrive */
    OFF,      /*  3 */  /* split_lo =  ON,  split_hi = OFF;  direct    */
     ON,      /*  4 */  /* split_lo = OFF,  split_hi =  ON;  overdrive */
    OFF,      /*  5 */  /* split_lo =  ON,  split_hi = OFF;  direct    */
     ON,      /*  6 */  /* split_lo = OFF,  split_hi =  ON;  overdrive */
    OFF,      /*  7 */  /* split_lo =  ON,  split_hi = OFF;  direct    */
     ON,      /*  8 */  /* split_lo = OFF,  split_hi =  ON;  overdrive */
    OFF,      /*  9 */  /* split_lo =  ON,  split_hi = OFF;  direct    */
     ON,      /* 10 */  /* split_lo = OFF,  split_hi =  ON;  overdrive */
      0,      /* 11 */
      0,      /* 12 */
      0,      /* 13 */
      0,      /* 14 */
      0,      /* 15 */
      0,      /* 16 */
      0,      /* 17 */
      0       /* 18 */
};

#pragma EJECT
```

```
static const uchar SPLITTER_TC_TABLE[23] =
{                       /* Splitter movement time constant in milliseconds */
      0,      /* -4 */
      0,      /* -3 */
    100,      /* -2 */  /* splitter = overdrive */
    100,      /* -1 */  /* splitter = direct    */
    100,      /*  0 */  /* splitter = direct    */
    100,      /*  1 */  /* splitter = direct    */
    100,      /*  2 */  /* splitter = overdrive */
    100,      /*  3 */  /* splitter = direct    */
    100,      /*  4 */  /* splitter = overdrive */
    100,      /*  5 */  /* splitter = direct    */
    100,      /*  6 */  /* splitter = overdrive */
    100,      /*  7 */  /* splitter = direct    */
    100,      /*  8 */  /* splitter = overdrive */
    100,      /*  9 */  /* splitter = direct    */
    100,      /* 10 */  /* splitter = overdrive */
      0,      /* 11 */
      0,      /* 12 */
      0,      /* 13 */
      0,      /* 14 */
      0,      /* 15 */
      0,      /* 16 */
      0,      /* 17 */
      0       /* 18 */
};

#pragma EJECT
```

```
/*****************************************************************************
*
* Function:  Initialize_Trans_Action
*
* Description:
*   This function initializes those module variables that must be set to a
*   know state on power up or reset.
*
*****************************************************************************/

void initialize_trans_action(void)
{

  gear_in_timer = 500;
  gear_out_timer = 500;
  g_ptr_old = 0;
  current_gear = 0;
  last_known_gear = 0;
  destination_gear = 0;
  transmission_position = OUT_OF_GEAR;
  low_speed_latch = TRUE;
  splitter_lo = 0;
  splitter_hi = 0;
  range_lo = 0;
  range_hi = 0;
  normal_auto_neutral_timer = 0;
  downshift_delayed = FALSE;
  manual_sync_delayed_timer = 0;
  jammed_in_wrong_gear_timer = JAMMED_TIME;
  R747_type = INTENT;
}
#pragma EJECT
```

```
/*****************************************************************************
*
* Function:  Check_For_Jammed_Gear
*
* Description:
*   This function checks for a indicated engaged gear, (g_ptr), that is different
*   than "destination_gear_selected" and will force the needed conditions to
*   recover.  This condition can occur when the transmission is "jammed" into
*   the wrong lever position, (usually with the clutch disengaged), during a
*   shift.
*
*****************************************************************************/

void check_for_jammed_gear(void)
{

  if ((shift_in_process == TRUE) &&
      (automatic_sip != 0) &&
      (destination_gear_selected != g_ptr) &&
      (g_ptr != 0) &&
      (jammed_in_wrong_gear_timer > 0))
     jammed_in_wrong_gear_timer--;

  if (jammed_in_wrong_gear_timer == 0)
  {
    shift_in_process = FALSE;
    automatic_sip = 0;
    desired_gear = current_gear;
    destination_gear = current_gear;
    destination_gear_selected = current_gear;
    jammed_in_wrong_gear_timer = JAMMED_TIME;
    engine_commands = ENGINE_RECOVERY;
  }


}

#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  determine_gear
 *
 * Description:
 *  This function determines the current gear that the transmission
 *  is in.  When conditions are such that the current gear can not be
 *  determined it will be set to a default, (0).
 *
 *  Note: When the error across the transmission is near zero for some
 *  time for a given test gear then it will be deemed in that gear.
 *
 *     trans_sync_error = input_spd/gf[gear] - gr[gear] * os
 *
 *****************************************************************************/
void determine_gear(void)
{

#define BIN_8                      256   /*    2 BIN 8  */
#define MAX_ERR                   4000   /*      RPM    */
#define WINDOW                      30   /*   30 RPM    */
#define GEAR_IN_TIME_LEVER         125   /*  250 MSEC @ 5 cnts per loop  */
#define GEAR_IN_TIME_AUTO           50   /*  100 MSEC @ 5 cnts per loop  */
#define GEAR_OUT_TIME                8   /*   80 MSEC   */
#define MANUAL_SYNC_DELAYED_TIME    45   /*  450 MSEC   */
#define ERROR_FUDGE_FACTOR           3   /*      RPM    */
#define NORMAL_AUTO_TIME           250   /*  2.5 SEC    */

#if (0)
   g_ptr = -1; /* lowest reverse ratio */

   /**  isdgf = input_speed_filtered / front box gear ratio  **/
   _bx = (signed int)(input_speed_filtered);
   _cx = BIN_8;
   _ax = trn_tbl.GF[g_ptr + GR_OFS];
   asm mul _cxdx, _bx;
   asm div _cxdx, _ax;
   isdgf = _cx;

   /**  gros = output_speed_filtered * rear box ratio  **/
   _bx = (signed int)(output_speed_filtered + ERROR_FUDGE_FACTOR);
   _cx = trn_tbl.GR[g_ptr + GR_OFS];
   _ax = BIN_8;
   asm mul _cxdx, _bx;
   asm div _cxdx, _ax;
   gros = _cx;

   trans_sync_error = (isdgf - gros);
   if (isdgf > gros)
      abs_trans_sync_error = (unsigned int)(isdgf - gros);
   else
      abs_trans_sync_error = (unsigned int)(gros - isdgf);
#endif

   abs_trans_sync_error = MAX_ERR;
   trans_window_calc = 0;

   if (abs_trans_sync_error > trans_window_calc)  /* if not in reverse, check for forward */
   {
     g_ptr = 1 + trn_tbl.highest_forward;
     abs_trans_sync_error = MAX_ERR;
     while ((abs_trans_sync_error > trans_window_calc) && (g_ptr != 0))
       {
         g_ptr--;
         /**  isdgf = input_speed_filtered / front box gear ratio  **/
         _bx = (signed int)(input_speed_filtered);
         _cx = BIN_8;
         _ax = trn_tbl.GF[g_ptr + GR_OFS];
         asm mul _cxdx, _bx;
         asm div _cxdx, _ax;
         isdgf = _cx;

         /**  gros = output_speed_filtered * rear box ratio  **/
         _bx = (signed int)(output_speed_filtered + ERROR_FUDGE_FACTOR);
         _cx = trn_tbl.GR[g_ptr + GR_OFS];
         _ax = BIN_8;
         asm mul _cxdx, _bx;
         asm div _cxdx, _ax;
         gros = _cx;
```

```
      trans_sync_error = isdgf - gros;
      if (isdgf > gros)
        abs_trans_sync_error = (int)(isdgf - gros);
      else
        abs_trans_sync_error = (int)(gros - isdgf);

     /* calculate trans sync error window based on gear pointer */
      _bx = WINDOW;                        /* BIN 0 */
      _cx = BIN_8;                         /* BIN 8 */
      _ax = trn_tbl.GF[g_ptr + GR_OFS];    /* BIN 8 */
      asm mulu _cxdx, _bx;                 /* make WINDOW BIN 8 */
      asm divu _cxdx, _ax;                 /* divide by front ration BIN 8 */
      trans_window_calc = _cx;             /* BIN 0 */
    }
}

if (g_ptr == 0)                            /* If in neutral, force values */
{
  abs_trans_sync_error = MAX_ERR;
  trans_sync_error = MAX_ERR;
  trans_window_calc = 0;
  isdgf = 0;
  gros = 0;
  downshift_delayed = FALSE;
  jammed_in_wrong_gear_timer = JAMMED_TIME;   /* Initialize for next occurance */
}

if ((abs_trans_sync_error > trans_window_calc) ||     /* Must have error for some */
  ((g_ptr != current_gear) && (current_gear != 0)))  /* before neutral state is  */
{                                                    /* recognized.              */
  if (gear_out_timer == 0)
  {
    transmission_position = OUT_OF_GEAR;
    current_gear = 0;
  }

  else
    gear_out_timer--;
}
else
  gear_out_timer = GEAR_OUT_TIME;


if ((g_ptr != g_ptr_old) || (g_ptr == 0) ||

    ((intent_to_shift_switch == TRUE) &&      /* intent to shift stuff */
     (in_gear_switch == FALSE) &&
     (engine_commands == ENGINE_SYNC) &&
     (shift_init_type == MANUAL))   ||
                                              /* if not in gear, init gear in timer.       */
    ((accelerator_pedal_position < 5) &&      /* Rule out picking a gear when coasting     */
     (input_speed < 700) &&                   /* down in neutral and no throttle.          */
     (low_speed_latch == FALSE)))             /* (Found that idle speed and output speed   */
{                                             /* would match a gear even when in neutral.) */
  if ((engine_commands == ENGINE_SYNC) ||     /* Note:   700 should be idle+100RPM         */
      (engine_commands == ENGINE_PREDIP))
  {
     if (engine_commands == ENGINE_PREDIP)                  /* Use a short in gear time   */
     {                                                      /* for splitter only shifts   */
       normal_auto_neutral_timer = 0;                       /* unless the system has been */
       manual_sync_delayed_timer = 0;                       /* in neutral too long.       */
     }                                                      /* EX: When driver pulls the  */
                                                            /* lever to neutral during a  */
     else                                                   /* splitter only shift.       */
       if (normal_auto_neutral_timer <= NORMAL_AUTO_TIME)
         normal_auto_neutral_timer++;

     if ((shift_init_type == AUTO) &&
         (normal_auto_neutral_timer < NORMAL_AUTO_TIME))
       gear_in_timer = GEAR_IN_TIME_AUTO;
     else
       gear_in_timer = GEAR_IN_TIME_LEVER;
  }
}

else
  if (gear_in_timer == 0)
  {
    current_gear = g_ptr;
```

```
      last_known_gear = g_ptr;
      transmission_position = IN_GEAR;
      normal_auto_neutral_timer = 0;     /* get ready for next time */
      downshift_delayed = FALSE;

      if ((intent_to_shift_switch == TRUE) && (engine_commands == ENGINE_SYNC))
        intent_hold = TRUE;

      if ((gos_current_gear > (downshift_point + 275)) &&
          (low_speed_latch == TRUE))
      {
        low_speed_latch = FALSE;
        destination_gear = current_gear;
        destination_gear_selected = current_gear;
        desired_gear = current_gear;
        lowest_forward = current_gear;
      }
      else
      {
        if (low_speed_latch == TRUE)
        {
          destination_gear = lowest_forward;           /* was set to 1 */
          destination_gear_selected = lowest_forward;  /* was set to 1 */
          desired_gear = lowest_forward;               /* was set to 1 */
          shift_in_process = FALSE;
        }
      }

      if (last_known_gear > 0)               /* Record REV/FOR data for */
        forward_last = TRUE;                 /* use in the select_gear  */
      else                                   /* module.                 */
        forward_last = FALSE;
    }
    else
    {
      if ((((shift_init_type == AUTO) || (low_speed_latch == TRUE) ||
          (manual_sync_delayed_timer >= MANUAL_SYNC_DELAYED_TIME))) &&
          (gear_in_timer >= 4))
        gear_in_timer -= 4;

      if (gear_in_timer > 0)
        gear_in_timer--;

      if (destination_gear_selected == g_ptr)    /* Prevent splitter shift while    */
        downshift_delayed = TRUE;                /* still confirming a lever shift. */

    }

  check_for_jammed_gear();

  g_ptr_old = g_ptr ;

  if (((engine_commands == ENGINE_SYNC) ||                    /* manual_sync_delayed_timer is used to allow the sync  */
       (engine_commands == ENGINE_FOLLOWER)) &&               /* mode's first pass a chance to pass the engine speed  */
      (manual_sync_delayed_timer < MANUAL_SYNC_DELAYED_TIME))  /* thru sync and give the mechanicals a chance to       */
    manual_sync_delayed_timer++;                              /* transition.  At this time a false in_gear signal     */
                                                              /* should be avoided. */

  if (output_speed_filtered < 125)          /* If stopped; set low speed latch */
  {
    current_gear = 0 ;
    transmission_position = OUT_OF_GEAR;
    low_speed_latch = TRUE;

    if (splitter_launch_state == LO_SPLITTER)
    {
     if ((lowest_forward == 2) ||
         (lowest_forward == 4) ||
         (lowest_forward == 6))
       lowest_forward--;
    }
    else
    {
     if ((lowest_forward == 1) ||
         (lowest_forward == 3) ||
         (lowest_forward == 5))
       lowest_forward++;
    }
  }
}
```

```
#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  determine_range_status
 *
 * Description:
 *  This function determines the status the of range.
 *
 *  rng_err = rear_counter_spd - (range_ratio * output_spd)
 *
 *  rcs = 54/21 * 44 * os (for low range)
 *
 *  rcs = 42/51 * 44 * os (for high range)
 *
 *****************************************************************************/

void determine_range_status(void)
{

#define BIN_12            4096   /* 2 bin 12   */
#define HI_RANGE_GEAR        7
#define LO_RANGE_CAL     10532   /* 54/21 BIN 12 */
#define HI_RANGE_CAL      3373   /* 42/51 BIN 12 */
#define RANGE_WINDOW_POS    30   /*  30 RPM      */
#define RANGE_WINDOW_NEG   -30   /* -30 RPM      */


/***  This code was never tested or used during the concept development ***/
/***  phase.  However, it is likely to be needed for range protection   ***/
/***  in the product.                                                   ***/


  if (destination_gear >= HI_RANGE_GEAR)
    range_cal = HI_RANGE_CAL;
  else
    range_cal = LO_RANGE_CAL;

  range_error =(((aux_speed * BIN_12)
              - (range_cal * output_speed_filtered))/BIN_12);

  if ((range_error > RANGE_WINDOW_POS) || (range_error < RANGE_WINDOW_NEG))
    aux_box = OUT_OF_GEAR;
  else
    aux_box = IN_GEAR;

}

#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  determine_range_state
 *
 * Description:
 *  This function determines the correct state for the range.
 *
 *****************************************************************************/

void determine_range_state(void)
{


    if (range_select_switch == HIGH)
    {
      range_lo = OFF;       /* Turn off the low range solenoid */
      range_hi = ON;        /* Turn on the high range solenoid */
    }
    else
    {
      range_lo = ON;        /* Turn on the low range solenoid   */
      range_hi = OFF;       /* Turn off the high range solenoid */
    }

}


#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  determine_splitter_state_autosplit
 *
 * Description:
 *  This function determines the correct state for the splitter.
 *  Once the transmission is in gear both splitter solenoids are turned off.
 *
 *****************************************************************************/

void determine_splitter_state_autosplit(void)
{
#define SPLTR_SYNC_OFFSET_POS    80   /*  80 RPM   */
#define SPLTR_SYNC_OFFSET_NEG   -80   /* -80 RPM   */
#define SPLITTER_TIME            20   /* 200 MSEC  */


  if (engine_status == ENGINE_PREDIP_MODE)    /* The splitter_timer will keep the */
    splitter_timer = SPLITTER_TIME;           /* solenoids on for a short time    */
  else                                        /* once the SYNC mode is entered.   */
    if (splitter_timer > 0)                   /* This allows the splitter enough  */
      splitter_timer--;                       /* time to move. (i.e., when the    */
                                              /* splitter changes during SYNC.    */

  splitter_tc = SPLITTER_TC_TABLE[destination_gear + GR_OFS];

  input_speed_modified = (signed int)(input_speed_filtered) +
                       (input_speed_accel_filtered/(1000/splitter_tc));

  if ((input_speed_modified < (gos_signed + SPLTR_SYNC_OFFSET_POS)) &&
      (input_speed_modified > (gos_signed + SPLTR_SYNC_OFFSET_NEG)))
    splitter_within_sync = TRUE;
  else
    splitter_within_sync = FALSE;

  if ((intent_to_shift_switch == TRUE) &&                  /* Allows for pre-selection */
      (desired_gear != destination_gear_selected) &&       /* of the splitter.         */
      (intent_hold == FALSE) &&
      (automatic_sip == 0) &&
      (shift_init_type == MANUAL) &&
      (transmission_position == IN_GEAR))
  {
    splitter_hi = SPLITTER_HI_TABLE[desired_gear + GR_OFS];
    splitter_lo = SPLITTER_LO_TABLE[desired_gear + GR_OFS];
  }

  else                                                 /* "Normal" splitter control */
  {
    if ((splitter_timer > 0) ||

        ((transmission_position == IN_GEAR) &&
         (shift_in_process == FALSE)) ||

        (low_speed_latch == TRUE) ||

        (engine_status == ENGINE_RECOVERY_MODE) ||

        ((shift_init_type == MANUAL) &&
         (engine_status == ENGINE_SYNC_MODE)) ||

        ((shift_init_type == AUTO) &&
         (engine_status == ENGINE_SYNC_MODE) &&
         (splitter_within_sync == TRUE)))
    {
      splitter_hi = SPLITTER_HI_TABLE[destination_gear + GR_OFS];
      splitter_lo = SPLITTER_LO_TABLE[destination_gear + GR_OFS];
    }

    else
    {
      splitter_hi = OFF;
      splitter_lo = OFF;
    }
  }
}
#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  determine_splitter_state_dual_force
 *
 * Description:
 *  This function determines the correct state for the splitter.
 *
 *****************************************************************************/

void determine_splitter_state_dual_force(void)
{
    if ((clutch_state == DISENGAGED) ||        /* use normal forces */
        (desired_gear > 6))
    {
      splitter_lo = ON;

    }

    else
    {
      if (splitter_select_switch == HIGH) /* use high force into overdrive */
        splitter_lo = OFF;
      else
        splitter_lo = ON;
    }

    if (splitter_select_switch == HIGH)
      splitter_hi = ON;
    else
      splitter_hi = OFF;

}

#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  determine_splitter_state_base
 *
 * Description:
 *  This function determines the correct state for the splitter.
 *
 *****************************************************************************/

void determine_splitter_state_base(void)
{

    splitter_lo = ON;

    if (splitter_select_switch == HIGH)
      splitter_hi = ON;
    else
      splitter_hi = OFF;

}

#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  determine_splitter_state
 *
 * Description:
 *  This function determines the correct state for the splitter.
 *
 *****************************************************************************/

void determine_splitter_state(void)
{

  if (R747_type == BASE)
    determine_splitter_state_base();

  else
    if (R747_type == DUAL_FORCE)
      determine_splitter_state_dual_force();

    else
      determine_splitter_state_autosplit();
}


#pragma EJECT
```

```
/*****************************************************************************
*
* Function:  Transmission_Action
*
* Description:
*      This function controls the states of the system ouput devices.
*
*****************************************************************************/
void transmission_action(void)
{

  initialize_trans_action();      /* initialize variables */

   x_start_periodic();
   while (1)
   {

    determine_gear();              /* calculate the current gear */
    determine_range_status();      /* determine range state */
    determine_range_state();       /* determine correct state  for range */
    determine_splitter_state();    /* determine correct state for splitter */

    x_sync_periodic(US_PER_LOOP);
   }
   x_end_periodic();
}
```

1-11-95 Demo to

Files from C:\RON\R747\INTENT\INTENT.ZIP

DRL_CMDS.C96	12/09/94
PR_S_I_S.C96	12/12/94
SEL_GEAR.C96	12/12/94
SEQ_SHFT.C96	12/12/94
TRNS_ACT.C96	12/12/94

```
/*****************************************************************************
 *
 *        Unpublished and confidential.  Not to be reproduced,
 *        disseminated, transferred or used without the prior
 *        written consent of Eaton Corporation.
 *
 *        Copyright Eaton Corporation, 1993-94.
 *        All rights reserved.
 *
 *****************************************************************************
 *
 * Filename:  drl_cmds.c96      (R-747) (AutoSplit)
 *
 * Description:
 *      The functions in this file will perform the required operations
 *      for controlling driveline components on the J1939 communication link.
 *
 * Part Number:  <none>
 *
 *    Rev 1.4   09 Dec 1994 14:29      markyvech
 * In function "control_engine_sync"; added code to allow smaller sync
 * offsets if the intent to shift switch is depressed.  This allows easier
 * shift lever insertion. (Note: the gear cannot be confirmed until the
 * switch is released.)
 *
 *    Rev 1.3   09 Dec 1994 11:18      markyvech
 * In function "control_engine_predip"; added code to allow recovery mode if
 * the intent switch is released before neutral is achieved.  Also added the
 * pr_s_i_s.h to get the intent_to_shift_switch variable. Also added a faster
 * torque ramp off rate for manual intent to shifts
 *
 *    Rev 1.2   08 Dec 1994 14:44      markyvech
 * Changed the offsets in "control_engine_sync" from +-65 to +-45 RPM.  Also
 * changed the input speed filter constant, (IS_FK1), from 236 to 235.
 *
 *    Rev 1.1   07 Dec 1994 15:33      markyvech
 * Took out the rear counter shaft speed substitution for output shaft speed
 * because there is no rear counter shaft speed sensor.
 *
 *    Rev 1.0   14 Sep 1994 10:48:40   markyvech
 * Initial revision.
 *
 *****************************************************************************/


/*****************************************************************************
 *
 * Header files included.
 *
 *****************************************************************************/

#include <exec.h>           /* executive information */
#include <c_regs.h>         /* KR internal register definitions */
#include <wwslib.h>         /* contains common global defines */
#include "cont_sys.h"       /* control system information */
#include "conj1939.h"       /* defines interface to j1939 control module */
#include "drl_cmds.h"       /* driveline commands information */
#include "trn_tbl.h"        /* transmission table data structures */
#include "sel_gear.h"       /* access to speed filter values */
#include "calc_spd.h"
#include "trns_act.h"
#include "pr_s_i_s.h"

#pragma noreentrant

/*****************************************************************************
 *
 * #defines local to this file.
 *
 *****************************************************************************/

#define US_PER_LOOP 10000U

#define ACTIVE_RECOVERY_GEAR 10   /* rule out boosting downs for now */

/*****************************************************************************
 *
 * Constants and variables declared by this file.
 *
```

```
*****************************************************************************/

/* public */

register unsigned char engine_commands;
register unsigned char engine_status;

unsigned char  desired_sync_test_mode;
unsigned char  forced_predip;
unsigned int   desired_engine_speed_test;
unsigned int   desired_engine_speed_ramp;
unsigned char  desired_engine_speed_timer;
unsigned char  desired_engine_speed_time;
unsigned char  eng_brake_command;
unsigned char  eng_brake_assist;
unsigned char  positive_pedal_trans;
unsigned char  sync_first_pass_timer;
/* unsigned char  clutch_state; */
unsigned int   clutch_slip_speed;
  signed int   dos_filtered;
  signed int   overall_error;
unsigned int   os_based_on_rcs;
unsigned int   input_speed_filtered;
  signed int   dgos;
  signed int   input_speed_accel_filtered;
unsigned int   output_speed_filtered;
unsigned long  is_filtered_bin8;
unsigned long  os_filtered_bin8;
  signed long  dis_filtered_bin8;

  signed char  eng_percent_torque_filtered;
  signed char  percent_torque_accessories;
  signed char  needed_percent_for_zero_flywheel_trq;
unsigned char  zero_flywheel_trq_timer;
unsigned char  zero_flywheel_trq_time;
unsigned char  accelerator_pedal_position_old;
unsigned int   gos;          /* overall destination gear ratio * output speed BIN 0 */
  signed int   gos_signed;   /* overall destination gear ratio * output speed BIN 0 */
  signed int   input_shaft_accel_calculated;

unsigned int   gos_current_gear;  /* overall current gear ratio * output speed BIN 0 */

unsigned char  sync_first_pass;
unsigned int   sync_maintain_timer;
  signed int   sync_offset;
  signed int   sync_offset_pos;
  signed int   sync_offset_neg;
  signed int   sync_dos_offset;
  signed int   sync_dos_offset_K1;
  signed int   sync_speed_modified;


/* local */

static unsigned int   predip_timer_1;
static unsigned char  predip_timer_2;
static unsigned char  predip_timer_3;
static   signed char  predip_torque_bump_value;
static unsigned char  predip_torque_bump_time;

static unsigned int   sync_on_timer;
static unsigned int   sync_off_timer;
static unsigned char  sync_dither_timer;

static unsigned int   torque_limit;
static unsigned char  recovery_cancel_timer;
static unsigned int   recov_coast_down_tmp1;
static unsigned int   recov_coast_down_tmp2;

static   signed int   lpf_output_accel;


#pragma EJECT
```

```
/*****************************************************************************
 *
 *                          PREDIP MODE CONSTANTS
 *
 *****************************************************************************/

#define PREDIP_ZERO_FDBK_TIME          40        /* 0.40s @10ms period */
#define PREDIP_TORQUE_ZERO_TIME        60        /* 0.60s @10ms period */
#define PREDIP_NORMAL_TIME            200        /* 2.00s @10ms period */
#define TORQUE_RAMP_OFF_RATE            1        /* 1% (per loop) */

#define PREDIP_TORQ_BUMP_VALUE_LO       0        /* 0% */
#define PREDIP_TORQ_BUMP_TIME_LO       15        /* 0.15s @10ms period */

#define PREDIP_TORQ_BUMP_VALUE_MED     10        /* 10% */
#define PREDIP_TORQ_BUMP_TIME_MED      25        /* 0.25s @10ms period */

#define PREDIP_TORQ_BUMP_VALUE_HI      25        /* 25% */
#define PREDIP_TORQ_BUMP_TIME_HI       30        /* 0.30s @10ms period */

/*****************************************************************************
 *
 *                          SYNC MODE CONSTANTS
 *
 *****************************************************************************/

#define  SYNC_DITHER_TIME_ABOVE        20        /* 0.20s @10ms period */
#define  SYNC_DITHER_TIME_BELOW        30        /* 0.30s @10ms period */
#define  SYNC_DITHER_RPM               35        /* 35 rpm             */
#define  SYNC_DITHER_FIRST_TIME       255        /* DUMMY VALUE        */

#define  MAINTAIN_SYNC_TIME           500        /* 5.00 Sec           */
#define  SYNC_FIRST_PASS_TIME         250        /* 2.50 Sec           */
#define  THREE_PERCENT                  3
#define  ENG_RESPONSE_UPSHF_TIME       10        /* 10 msec            */
#define  ENG_RESPONSE_DNSHF_TIME       10        /* 10 msec            */
#define  SYNC_DOS_OFFSET_CONSTANT    2816        /* 11 BIN 8           */

/*****************************************************************************
 *
 *                        RECOVERY MODE CONSTANTS
 *
 *****************************************************************************/

#define RECOVERY_CANCEL_TIME           10        /* 0.10s @10ms period */
#define RECOVERY_CANCEL_OFFSET         20        /* 20% BIN 0 */
#define RECOVERY_TORQUE_STEP         1280        /* 5% BIN 8 */
#define THLO_DS_ENG_DECAY_K1          450
#define THLO_DS_ENG_DECAY_RAMP          1        /* 1 rpm BIN 0 */
#define THLO_DS_FINISHED_DELTA        200        /* 200 rpm BIN 0 */

static const uint RECOVERY_RATE_TABLE[23] =
{
   0,          /* -4 */
   0,          /* -3 */
   128,        /* -2 : 0.50% per loop BIN 8 */
   128,        /* -1 : 0.50% per loop BIN 8 */
   128,        /*  0 : 0.50% per loop BIN 8 */
   128,        /*  1 : 0.50% per loop BIN 8 */
   128,        /*  2 : 0.50% per loop BIN 8 */
   128,        /*  3 : 0.50% per loop BIN 8 */
   128,        /*  4 : 0.50% per loop BIN 8 */
   192,        /*  5 : 0.75% per loop BIN 8 */
   192,        /*  6 : 0.75% per loop BIN 8 */
   192,        /*  7 : 0.75% per loop BIN 8 */
   281,        /*  8 : 1.10% per loop BIN 8 */
   281,        /*  9 : 1.10% per loop BIN 8 */
   281,        /* 10 : 1.10% per loop BIN 8 */
   0,          /* 11 */
   0,          /* 12 */
   0,          /* 13 */
   0,          /* 14 */
   0,          /* 15 */
   0,          /* 16 */
   0,          /* 17 */
   0           /* 18 */
};
```

```
/*****************************************************************************
 *
 * Function:  initialize_driveline_data
 *
 * Description:
 *      This function, called after all resets, will initialize the system
 *      copy of driveline related data received from the communications link.
 *
 *****************************************************************************/

static void initialize_driveline_data(void)
{
   accelerator_pedal_position = 0;
   engine_communication_active = FALSE;
   engine_brake_available = FALSE;
   eng_brake_command = ENG_BRAKE_IDLE;   /* should init with engine_commands */
/*   clutch_state = ENGAGED; */
   positive_pedal_trans = FALSE;
   zero_flywheel_trq_timer = 0;
   zero_flywheel_trq_time = 0;
   percent_torque_accessories = 3;

   desired_sync_test_mode = FALSE;   /* debug use only - delete later */
   desired_engine_speed_test = 0 ;   /* debug use only - delete later */
   desired_engine_speed_ramp = 0 ;   /* debug use only - delete later */
   desired_engine_speed_timer = 0;   /* debug use only - delete later */
   desired_engine_speed = 0;
   sync_dos_offset_K1 = SYNC_DOS_OFFSET_CONSTANT;
   desired_engine_speed_time = 0;
   forced_predip = FALSE;
}


#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  control_engine_predip
 *
 * Description:
 *      Determines throttle command for predip mode.
 *
 *      After a reasonable delay for the transmission to pull to neutral the
 *      torque will be cycled from zero to a determined value to help the
 *      transmission achieve neutral.
 *
 *****************************************************************************/

static void control_engine_predip(void)
{
   if (engine_status != ENGINE_PREDIP_MODE)
   {
      engine_status = ENGINE_PREDIP_MODE;

      predip_timer_1 = 0;
      predip_timer_2 = 0;
      predip_timer_3 = 0;

      if ((actual_engine_pct_trq < 5) || (forced_predip_timer > 0))
         predip_timer_1 = PREDIP_NORMAL_TIME;
      else
         desired_engine_pct_trq = actual_engine_pct_trq;
   }

   engine_control = TORQUE_CONTROL;
   command_ETC1 = C_ETC1_OVERSPEED;


   if ((intent_to_shift_switch == TRUE)) /* Allows for recovery mode if the "intent" switch */
     positive_pedal_trans = TRUE;        /* is released before neutral is achieved */


   if (predip_timer_1 < PREDIP_NORMAL_TIME)
   {
      if ((desired_engine_pct_trq >= TORQUE_RAMP_OFF_RATE) &&
         (actual_engine_pct_trq > 0))
      {
         desired_engine_pct_trq -= TORQUE_RAMP_OFF_RATE;

         if ((intent_to_shift_switch == TRUE) &&    /* faster rate for intent to shift */
             (shift_init_type == MANUAL) &&
             (actual_engine_pct_trq > 0))
           desired_engine_pct_trq -= 1;
      }
      else
      {
         desired_engine_pct_trq = 0;

         /* check to force bump if neutral not achieved */
         if (actual_engine_pct_trq < 10)
         {
            if (++predip_timer_3 >= PREDIP_ZERO_FDBK_TIME)
               predip_timer_1 = PREDIP_NORMAL_TIME;
         }
      }
      ++predip_timer_1;
   }
   else
   {
      if (((lpf_output_accel > -150) || (forced_predip_timer > 0)) &&
         (predip_timer_1 < (PREDIP_NORMAL_TIME + PREDIP_TORQUE_ZERO_TIME)))
      {
         predip_torque_bump_time = PREDIP_TORQ_BUMP_TIME_LO;
         predip_torque_bump_value = PREDIP_TORQ_BUMP_VALUE_LO + needed_percent_for_zero_flywheel_trq;
      }
      else
      {
         if (predip_timer_1 < (PREDIP_NORMAL_TIME + 2*PREDIP_TORQUE_ZERO_TIME))
         {
            predip_torque_bump_time = PREDIP_TORQ_BUMP_TIME_MED;
            predip_torque_bump_value = PREDIP_TORQ_BUMP_VALUE_MED + needed_percent_for_zero_flywheel_trq;
         }
         else
         {
```

```
            predip_torque_bump_time = PREDIP_TORQ_BUMP_TIME_HI;
            predip_torque_bump_value = PREDIP_TORQ_BUMP_VALUE_HI + needed_percent_for_zero_flywheel_trq;
         }
      }

      if (predip_timer_2 < predip_torque_bump_time)
      {
         desired_engine_pct_trq = predip_torque_bump_value;
         if (actual_engine_pct_trq > 0)
         {
            ++predip_timer_1;
            ++predip_timer_2;
         }
      }
      else
      {
         desired_engine_pct_trq = 0;
         ++predip_timer_1;
         ++predip_timer_2;
      }

      if (predip_timer_2 >= PREDIP_TORQUE_ZERO_TIME)
         predip_timer_2 = 0;
   }
}
#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  control_engine_sync    (AutoSplit)
 *
 * Description:
 *   This function synchronizes engine speed to output shaft speed
 *   during a shift.
 *
 *****************************************************************************/

static void control_engine_sync(void)
{
  if ((intent_to_shift_switch == TRUE) &&   /* Intent to shift conditions */
      (shift_init_type == MANUAL))          /* that allow lower offsets.  */
  {
    sync_offset_pos =  20;
    sync_offset_neg = -20;
  }

  else
  {
    sync_offset_pos =  45;                  /* normal AutoSplit offsets */
    sync_offset_neg = -45;
  }

  if (accelerator_pedal_position > THREE_PERCENT)
    sync_maintain_timer = MAINTAIN_SYNC_TIME;

  if ((engine_status != ENGINE_SYNC_MODE) || (sync_maintain_timer == 0))
  {
    sync_on_timer = 0;
    sync_off_timer = 0;
    sync_first_pass = TRUE;
    sync_first_pass_timer = SYNC_FIRST_PASS_TIME;

    if ((shift_type == UPSHIFT) && (shift_init_type == AUTO))
      sync_offset = sync_offset_neg;
    else
      sync_offset = sync_offset_pos;

    if (engine_status != ENGINE_SYNC_MODE)  /* first time through sync */
    {
      engine_status = ENGINE_SYNC_MODE;

      if (forced_predip == FALSE)
        sync_maintain_timer = MAINTAIN_SYNC_TIME;
    }
    else                          /* sync_maintain_timer reached 0 */
    {
      engine_control = OVERRIDE_DISABLED;
      command_ETC1 = C_ETC1_NORMAL;
    }
  }

  else
  {
    sync_maintain_timer--;

    if (sync_on_timer++ <= 200)      /* allow sync mode for about 2 seconds */
    {
      sync_off_timer = 0;
      engine_control = SPEED_CONTROL;
      command_ETC1 = C_ETC1_OVERSPEED;

      if (sync_first_pass == TRUE)
      {
        if ((shift_type == UPSHIFT) && (shift_init_type == AUTO))
        {
          sync_speed_modified = (signed int)(input_speed) +
                                (input_speed_accel_filtered /(1000/ENG_RESPONSE_UPSHF_TIME));

          if (sync_speed_modified < gos_signed)
          {
            if (sync_first_pass_timer == 0)
            {
              sync_offset = sync_offset_pos;
              sync_first_pass = FALSE;
            }
            else
```

```
            sync_first_pass_timer--;
          }
        }
        else   /* shift is a downshift */
        {
          sync_speed_modified = (signed int)(input_speed) +
                                (input_speed_accel_filtered /(1000/ENG_RESPONSE_DNSHF_TIME));

          if (sync_speed_modified > gos_signed)
          {
          /* if (sync_first_pass_timer == 0)  */
          /*  {                               */
              sync_first_pass = FALSE;
              if ((pct_demand_at_cur_sp < 15) || (shift_init_type == MANUAL))
                sync_offset = sync_offset_neg;
          /*  }                               */
          /* else                             */
          /*   sync_first_pass_timer--;       */
          }
        }
      }

      if (gos_signed + sync_offset > 0)
        desired_engine_speed = (int)(gos_signed + sync_offset);
      else
        desired_engine_speed = 0;

    }
    else
    {
      if (sync_off_timer <= 4)
        sync_off_timer++;

      else
      {
        sync_on_timer = 0;

        if (shift_init_type == AUTO)
          sync_offset = -(sync_offset);   /* force sync speed to toggle around gos */

        else
        {
          sync_first_pass = TRUE;
          sync_first_pass_timer = SYNC_FIRST_PASS_TIME;
          sync_offset = sync_offset_pos;
          manual_sync_delayed_timer = 0;  /* used in SEQ_SHFT.C96 module */
        }
      }
    }
  }
}
#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  control_engine_sync_test_mode    (AutoSplit)
 *
 * Description:
 *   This function test the synchronize mode of engine speed control.
 *
 *****************************************************************************/

static void control_engine_sync_test_mode(void)
{

      if (accelerator_pedal_position < 10)
      {
        engine_status = ENGINE_FOLLOWER_MODE;
        engine_commands = ENGINE_FOLLOWER;
        engine_control = OVERRIDE_DISABLED;
        command_ETC1 = C_ETC1_NORMAL;
        desired_engine_speed = 0;
      }
      else
      {
        if (accelerator_pedal_position > 90)
         {
           engine_status = ENGINE_SYNC_MODE;
           engine_commands = ENGINE_SYNC;
           engine_control = SPEED_CONTROL;
           command_ETC1 = C_ETC1_OVERSPEED;
           desired_engine_speed = desired_engine_speed_test;
           desired_engine_speed_timer = desired_engine_speed_time;
         }
         else
         {
           if (desired_engine_speed_timer > 0)
              desired_engine_speed_timer--;
           else
           {
             if (desired_engine_speed > 600)
             {
               desired_engine_speed_timer = desired_engine_speed_time;
               desired_engine_speed = (desired_engine_speed - desired_engine_speed_ramp);
             }
           }
         }
      }
}
#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  determine_if_recovery_complete
 *
 *   Description:
 *      This routine checks to see if the percent_torque_value_limit has
 *      exceeded the percent_torque_value feedback from the engine by x%
 *      for x milliseconds and will then set percent_torque_value_limit
 *      to 100% to cancel the recovery mode.
 *
 *****************************************************************************/

static void determine_if_recovery_complete(void)
{
   if ((net_engine_pct_trq > 10) &&
      (desired_engine_pct_trq > (net_engine_pct_trq + RECOVERY_CANCEL_OFFSET)))
   {
      ++recovery_cancel_timer;
   }
   else
      recovery_cancel_timer = 0;

   if ( (recovery_cancel_timer >= RECOVERY_CANCEL_TIME) ||
      (desired_engine_pct_trq == 100) )
   {
      /* terminate the recovery mode */
      desired_engine_pct_trq = 100;
      engine_status = ENGINE_RECOVERY_MODE_COMPLETE;
   }
}

#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  control_engine_recovery_normal
 *
 * Description:
 *      Determine throttle command for recovery mode.
 *      TORQUE_LIMIT is scaled as a BIN 8 number representing the percentage
 *      of torque allowed to the engine during recovery.
 *
 *****************************************************************************/

static void control_engine_recovery_normal(void)
{
   engine_control = SPEED_TORQUE_LIMIT;
   command_ETC1 = C_ETC1_NORMAL;

   desired_engine_speed = 8031;   /* torque limit only, max value for speed */

   torque_limit += RECOVERY_RATE_TABLE[destination_gear+4];   /* BIN 8 */

   desired_engine_pct_trq = (char)(torque_limit >> 8);   /* BIN 0 */

   determine_if_recovery_complete();
}

#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  control_engine_recovery_coasting
 *
 * Description:
 *      Determine throttle command for coasting down shifts mode.
 *
 *****************************************************************************/

static void control_engine_recovery_coasting(void)
{
   register uint local_uint;

   if (sync_on_timer <= 300)
   {
      ++sync_on_timer;

      engine_control = SPEED_CONTROL;
      command_ETC1 = C_ETC1_NORMAL;

      sync_off_timer = 0;

      /** recov_coast_down_tmp1 = gos + (dgos * K1) - THLO_DS_ENG_DECAY_RAMP **/

      if (dgos < 0)          /* get absolute value */
         _cx = (uint)-dgos;
      else
         _cx = (uint)dgos;

      asm mulu _cxdx, #THLO_DS_ENG_DECAY_K1;       /* BIN 12 */
      asm shrl _cxdx, #12;                         /* BIN 0 */

      if (_cxdx > 500)                            /* error check */
         local_uint = 0;
      else
         local_uint = _cx;

      if (lpf_output_accel > 0)
         recov_coast_down_tmp1 = (gos + local_uint) - THLO_DS_ENG_DECAY_RAMP;
      else
         recov_coast_down_tmp1 = (gos - local_uint) - THLO_DS_ENG_DECAY_RAMP;

      /** recov_coast_down_tmp2 = desired_engine_speed - THLO_DS_ENG_DECAY_RAMP **/

      recov_coast_down_tmp2 = desired_engine_speed - THLO_DS_ENG_DECAY_RAMP;

      if (recov_coast_down_tmp1 < recov_coast_down_tmp2)
         desired_engine_speed = recov_coast_down_tmp1;
      else
         desired_engine_speed = recov_coast_down_tmp2;
   }
   else
   {
      if (sync_off_timer <= 5)
      {
         ++sync_off_timer;
         engine_control = TORQUE_CONTROL;
         command_ETC1 = C_ETC1_NORMAL;
         desired_engine_pct_trq = 0;
      }
      else
         sync_on_timer = 0;
   }

   if ((desired_engine_speed + THLO_DS_FINISHED_DELTA) < gos)
   {
      /* terminate the recovery mode */
      desired_engine_pct_trq = 100;
      engine_status = ENGINE_RECOVERY_MODE_COMPLETE;
   }
}

#pragma EJECT
```

```
/*****************************************************************************
 *
 * Function:  control_engine_recovery
 *
 * Description:
 *      This function determines which type of throttle recovery should be
 *      used.  And initializes some of the variables that will be used.
 *
 *****************************************************************************/

static void control_engine_recovery(void)
{

   if ((engine_status != ENGINE_RECOVERY_MODE) &&
      (engine_status != ENGINE_RECOVERY_MODE_COMPLETE))
   {
      engine_status = ENGINE_RECOVERY_MODE;
      desired_engine_pct_trq = 0;
      recovery_cancel_timer = 0;
      sync_on_timer = 0;
      sync_off_timer = 0;

      /* reset pedal transition variables */
      positive_pedal_trans = FALSE;
      positive_pedal_trans = FALSE;
      zero_flywheel_trq_timer = 0;
      zero_flywheel_trq_time = 0;


      if (gos < desired_engine_speed)
         desired_engine_speed = gos;

      /* set initial starting torque limit */      /* percent, BIN 8 */
      if ((actual_engine_pct_trq > needed_percent_for_zero_flywheel_trq) &&
          (pct_demand_at_cur_sp > 5))
        torque_limit = ((unsigned int)(actual_engine_pct_trq))<<8; /* percent, BIN 8 */
      else
        torque_limit = ((unsigned int)(needed_percent_for_zero_flywheel_trq))<<8; /* percent, BIN 8 */
   }

   if ((destination_gear > ACTIVE_RECOVERY_GEAR) &&
      (pct_demand_at_cur_sp < 5) &&
      ((shift_type == COAST_DOWN_SHIFT) ||
      (shift_type == UPSHIFT)))
   {
      control_engine_recovery_coasting();
   }
   else
   {
      control_engine_recovery_normal();
   }
}

#pragma EJECT
```